LIBRARY OF COLLEGE OF
MEDICAL EVANGELISTS
LOMA LINDA, CAL.

The Journal of the

American Medical Association

VOL. XXIX. CHICAGO, ILL., OCTOBER 30, 1897. No. 18

ORIGINAL ARTICLES.

THE PRESENT STATUS OF PREVENTIVE MEANS AGAINST THE SPREAD OF TUBERCULOSIS IN THE VARIOUS STATES OF THE UNION CRITICALLY REVIEWED.

Presented to the Section on State Medicine, at the Forty-eighth Annual Meeting of the American Medical Association, held at Philadelphia, June 1-4, 1897.

BY S. A. KNOPF, M.D. (PARIS AND BELLEVUE, N. Y.)
PHYSICIAN TO THE LUNG DEPARTMENT OF THE NEW YORK THROAT AND NOSE HOSPITAL; FORMER ASSISTANT TO PROFESSOR DETTWEILER, FALKENSTEIN SANATORIUM, GERMANY; FELLOW OF THE NEW YORK ACADEMY OF MEDICINE, ETC., NEW YORK.

In order to ascertain the exact condition of prophylaxis in regard to tuberculosis, I have addressed letters of inquiry to all the secretaries of the State boards of health of all the States and Territories of the Union, and to the health officers of forty of the largest cities. To all the gentlemen who by their prompt replies so kindly aided me in compiling this report, I wish to express my sincere thanks and appreciation. Here are the results of my inquiries:

Alabama.—No laws or regulations concerning tuberculosis in man or beast, and no circulars issued.

Arkansas.—No laws, regulations or circulars concerning tuberculosis. Dr. Jennings, the executive officer, writes that the State not having made any appropriation, the board is handicapped for want of funds.

California.—Good bovine laws and regulations, circular issued on consumption.

Colorado.—Good bovine laws and regulations and a special circular, "How to prevent the spread of consumption in Colorado."

Connecticut.—Good bovine laws enforced by the State Board of Agriculture, and a circular on consumption, its cause and means of prevention.

Delaware.—Circular on the prevention of consumption.

District of Columbia.—Only one law in regard to tuberculosis, which forbids the sale of milk that may be tuberculous. No circulars or public notices.

Georgia.—There was formerly a State board of health but it has been allowed to become extinct for lack of appropriation.

Idaho.—No State board of health. Provision is made for the appointment of health officers by the various boards of county commissioners, but they are answerable to the local authority only.

Illinois.—The board has never passed any laws or resolutions concerning tuberculosis and no circulars have been issued.

Indiana.—No bovine laws yet, but the question is agitated. The board issues 2,000 quarterly bulletins free to all county, city and town health officers, and to others who may subscribe for them.

Iowa.—The board is very active in educating physicians and laity in regard to tuberculosis and is enforcing its bovine laws with vigor.

Kansas.—No laws, regulations nor circulars concerning tuberculosis in man or beast. The legislature failed to make any appropriation and the State veterinary office is abolished.

Kentucky.—For want of appropriation, the board has undertaken no work in regard to bovine tuberculosis, but a circular on consumption has been issued.

Louisiana.—Circulars are sent to physicians, and stations for the free examination of sputum have been established, but the attempts of the board to secure legislation in regard to bovine tuberculosis have been thwarted by concert of action on the part of the ignorant and prejudiced Creoles, who have almost entire control of the dairy business.

Maine.—The cattle commissioners are authorized to slaughter tuberculous cattle and reimburse the owners, and the board has issued a circular on consumption.

Maryland.—No laws, regulations or circulars on tuberculosis.

Massachusetts.—Five cattle commissioners appointed by the Governor are entrusted with the suppression of bovine tuberculosis. A circular on the best means of preventing consumption is issued.

Michigan.—The State Live Stock Commission is entrusted with the work concerning the suppression of bovine tuberculosis. Circulars for public instruction are issued. Sept. 30, 1893, resolutions were adopted to include consumption in the official list of diseases dangerous to the public health.

Minnesota.—Good bovine laws. I received no report in regard to provisions concerning tuberculosis in man.

Mississippi.—No laws, regulations or circulars concerning tuberculosis in man or beast. With the reorganization of the board, better work is hoped for.

Missouri.—No answer to my inquiries, but I learn from the daily paper that the State Board recommends public lectures on the question in the more populous centers, and all pupils of the public schools throughout the State be given a course of instruction in the causes of consumption and means by which it may be prevented.

Montana.—No State board of health.

Nebraska.—The board at present is a mere licensing body without sanitary powers.

New Hampshire.—No special regulations on the prevention or restriction of tuberculosis, but some papers on the subject have been printed. In 1891 the legislature enacted a law creating a State Board of Cattle Commissioners.

New Jersey.—The State Board of Agriculture enforces the bovine laws and a circular on consumption has been issued.

New Mexico.—The Territorial Board has noticed

the increase of phthisis among natives of the Territory and has traced many cases to an exposure to possible infection, New Mexico being a favorite resort for consumptives. Circulars on consumption are profusely distributed and last year the board passed resolutions encouraging the testing of domestic animals with tuberculin.

New York.—Good bovine laws not very rigidly enforced because the State appropriation is small. Most efficient work was done at first by the Tuberculosis Committee of the board, but there was no appropriation last year, in spite of the fact that it has been demonstrated that there are at this time 75,000 tuberculous cows in the State.[1] Circulars like those of the New York City Board have been issued. To New York belongs the credit of having done the pioneer work in educating the public to the dangers of tuberculosis. The State board requests all local health officers to register name and address of every person suffering from tuberculosis within their respective jurisdictions.

North Carolina.—No laws, regulations or circulars concerning tuberculosis in man or beast.

North Dakota.—No laws, regulations or circulars concerning tuberculosis in man or beast.

Ohio.—No bovine laws. A circular on the prevention of consumption has been issued.

Oklahoma.—There is a law prohibiting the sale and use of milk from cows not in proper condition of health. Nothing else is done in regard to the prevention of tuberculosis.

Oregon.—No State board.

Pennsylvania.—The State Live Stock Sanitary Board is entrusted with full power to suppress bovine tuberculosis. The Board of Health has passed resolutions that tuberculosis be added to the list of communicable diseases dangerous to the public health. Circulars are issued and the Pennsylvania Society for the Prevention of Tuberculosis is in a flourishing condition, although it does not receive any aid or encouragement from the State.

Rhode Island.—Circulars are freely issued. Sputum is examined free of charge and $10,000 yearly is expended to enforce bovine regulations.

South Carolina.—No bovine laws. Some years ago circulars were printed and distributed, but no more appropriation for this purpose having been forthcoming nothing is now done.

South Dakota.—There is a law providing for the destruction of tuberculous animals and carcasses; nothing concerning tuberculosis in man. Provision is hoped for from the next legislature.

Tennessee.—Circulars on the prevention of tuberculosis in man and beast have been issued. There are bovine laws, but owing to want of funds the board has been deterred from formal action up to this time.

Texas.—The Quarantine Department is the highest sanitary authority. Its powers are limited to epidemic diseases. Circulars on tuberculosis have been sent to physicians. There are no bovine laws.

Utah.—No board of health or any organization of a similar kind whatsoever.

Vermont.—No answer, but I learn indirectly that this State kills tuberculous cattle and recompenses the owner.

Virginia.—Bovine laws are enforced by the Board of Control of the Experimental Station of the Virginia Agricultural and Mechanical College at Blacksburg. Circulars on the restriction of consumption are issued.

West Virginia.—No bovine laws. Circulars on consumption have been issued.

Wisconsin.—The board of health and the State Veterinarian co-operate in destroying milch cows that are tuberculous. Circulars on tuberculosis in man are issued.

Wyoming.—No State board of health. During the legislative sessions of 1895 a bill was introduced to create one, but it was not passed. Sanitary regulations are left to the cities, some of which have boards appointed by ordinance.

This gives us: Fourteen States which have bovine laws and regulations and in which circulars are issued for public instruction in regard to tuberculosis in man, viz.: California, Colorado, Connecticut, Iowa, Maine, Massachusetts, Michigan, New Jersey, New Hampshire, New York, Pennsylvania, Rhode Island, Virginia and Wisconsin; two which have bovine laws but where apparently nothing is done to stop the spread of tuberculosis in man, viz.: Minnesota and South Dakota; one which has bovine laws but can not enforce them for lack of funds and where thus far the board has only issued circulars on the prevention of tuberculosis in man and beast, viz.: Tennessee; two (the District of Columbia and Oklahoma Territory) which have a law prohibiting the sale of tuberculous milk, but nothing else concerning tuberculosis in man or beast; eight which issues circulars of instruction concerning tuberculosis in man, but where nothing is done in regard to bovine tuberculosis, viz.: Delaware, Indiana, Kentucky, Louisiana, New Mexico Territory, Ohio, Texas and West Virginia; nine where nothing is done to stop the spread of tuberculosis in either man or beast, viz.: Alabama, Arkansas, Illinois, Kansas, Maryland, Mississippi, North Carolina, North Dakota and South Carolina; seven which have no board of health, viz.: Georgia, Idaho, Montana, Nebraska, Oregon, Utah and Wyoming; five from which I have received no answer, viz., Florida, Missouri, Nevada, Vermont and Washington.

To the letters addressed to the health officers of forty of our largest cities I received twenty-nine answers. In one-third of these it was stated that nothing at all had been done concerning the prophylaxis of tuberculosis.

This state of affairs speaks for itself and shows that as a nation we have a most limited protection from tuberculosis in man and beast.

Let us consider for a moment the injustice done to States with good laws in regard to bovine tuberculosis by those which have no such laws. Where interstate traffic exists it will be well-nigh impossible for the States with good sanitary laws to suppress bovine tuberculosis within their borders. The following incident which I have from a reliable source will show a danger and injustice to which a State with good laws is no doubt frequently exposed: A farmer in a State with no laws to suppress bovine tuberculosis entered into a compact with a friend residing in a neighboring State where the government kills all tuberculous cattle and recompenses the owner; all the worthless cattle which he can procure are driven across the line to the friend. At the next visit of the State veterinary surgeon these cattle are found tuberculous, ordered killed and, considering their real value, handsomely paid for. The farmer and his

[1] Cassidy and Smith: "Tuberculosis—It is the Duty of the State to Suppress the Greatest Destroyer of the Human Race."

friend divide the profit. This may be the first direct loss in money to the State with good laws, but how many times may not these diseased cows, secretly imported, be the cause of infecting whole herds of valuable cattle? And yet the citizens of the State with good laws in regard to tuberculous cattle, though imposed upon, are to be envied, for the State with no such laws is an unsafe place to live in. The following extract from the "Eighth Biennial Report of the Iowa State Board of Health" will show how true this is. "Some time since the State veterinary surgeon found a lot of cattle which he condemned as tuberculous, placing them under quarantine and expecting in a day or two to slaughter them. Upon his return he found that the cattle had been sold to be shipped out of the State for food." The seller claimed that he had fully made known the condition of the cattle to the buyer and thus the law could not reach him. The danger from tuberculous meat, milk and butter has been, I fear, underestimated in years past, and I am willing to admit that I, myself, in previous publications, have considered with many others the dissemination of the germs contained in carelessly deposited sputum of tuberculosis patients the prime and most important factor in communicating the disease to others, but I recently undertook to trace the etiology in regard to antecedents, environments, personal and family history, in as many published cases as I could procure accounts of, and I was surprised to find in how large a number one was justified in excluding the inhalation of bacilli, as the etiologic factor. A farmer, cowboy, gardener, wood-chopper or any other individual living most of the time in the open air, residing in an isolated district where consumption is rare or almost unknown, with no family history of tuberculosis, sickens and dies of pulmonary phthisis. Now, while it is true that primary intestinal tuberculosis is of relatively rare occurrence in adults, we can account for this by the fact that they do not take tuberculous milk as their exclusive nourishment as may be the case with an unfortunate child whose delicate intestinal epithelium becomes the abiding place of the tubercle bacillus contained in countless quantities in every meal the child takes. In the adult the ingested bacillus, in the majority of cases, seems to pass through the lymphatic system into the circulation of the blood to find its favorite lodging place in the badly ventilated apices. It is well known that the bactericidal quality of the gastric secretions is insufficient to destroy the germ of tuberculosis[2] and the only defence against this mode of invasion seems to be the good phagocytic power of the blood of the healthy individual. Now when we consider that milk, butter and meat of cattle constitute the most important and universally used articles of food for man and how relatively recently laws in regard to bovine tuberculosis have been enacted at all, and in how many States such laws do not yet exist, I think it is not surprising when looking into the exact etiology of cases of pulmonary consumption that we find a very large number must certainly have been caused by the ingestion and not the inhalation of the bacillus.

After arriving at this conclusion, I was much gratified on a recent visit to Dr. von Ruck's sanatorium in Asheville, N. C., to hear his opinion in this matter. He told me that to judge from a carefully kept history of many thousand cases from all over the United States which have come under his observation, the majority of cases of pulmonary tuberculosis, in his opinion, had their origin in the ingestion of tuberculous food of some kind. Dr. F. W. Smith of the Tuberculosis Committee of the State Board of Health of New York seems to be of a similar opinion, for he wrote me, "the first great step toward the prophylaxis of tuberculosis in man is to stamp out the disease in cattle."

Let us then, in our war against tuberculosis, divide our attention equally between the bacilli which may be ingested and the bacilli which may be inhaled, and we may then perhaps hope for a victory.

To effectually combat tuberculosis in cattle and other domestic animals, the Federal Government, having equal jurisdiction over all the States and Territories, is alone capable to do the work. How this should be accomplished enters not into the scope of this paper. Abler men than myself will outline the workings of such a National institution which might justly have its center in the Bureau of Animal Industry in Washington, which has already done such excellent work in the direction of preventing bovine tuberculosis.[3] But as physicians entrusted with the care and preservation of the lives of American citizens, we should appeal to the United States Government to take the matter of stopping the spread of tuberculosis through the bovine race into its own powerful hands. By a judicious legislation and proper enforcement of laws in this direction thousands of precious human lives would be saved, and individuals and communities would ultimately be spared the loss and destruction of valuable livestock and property.

While the advisability of Federal laws in regard to the prevention of human tuberculosis may be contested, there is one feature of the prophylaxis of consumption which seems to me should enter into the domain of Government supervision. I refer to the disinfection of passenger and sleeping cars. This seems to me especially desirable and needful on roads much frequented by pulmonary invalids. The insanitary arrangement of these vehicles, especially the sleeping cars, must be evident to any one who has given the matter any attention. Only a few weeks ago when going south I had three traveling companions in the more advanced stages of pulmonary tuberculosis, one unable to leave his berth during the daytime. They were all male patients, and with them the rest of the male passengers, the conductor, the trainman and the colored porter enjoyed the privilege of one drinking glass. The patients coughed and expectorated a good deal, sometimes hitting and sometimes missing the small hole in the flat cuspidor, which contained no liquid whatsoever. Draw your conclusions from this as to the safety of the innocent traveler with a little bronchitis entering this car in a condition of accidently enfeebled health, or with a natural predisposition to consumption. A few days later I returned with the same car and I am sure it had not been disinfected since I traveled in it southward.

Now I am told that it is impossible to hinder a consumptive from entering a Pullman car, and that if there

[2] Straus et Wurtz: "De l'action du suc gastrique sur le bacille de la tuberculose" (Arch. de méd. expérim., 1889, p. 370).

[3] Salmon, D. E., D.V.M., Chief of the Bureau of Animal Industry. "The Federal Meat Inspection."

Smith, Theobald, M.D., Chief of the Division of Animal Pathology, Bureau of Animal Industry: "Some Practical Suggestions for the Suppression and Prevention of Bovine Tuberculosis."

were a law whereby he could be prevented from doing so, it would be well nigh impossible to enforce it. I grant this to be true, but if our wealthy railroad corporations which habitually carry consumptives to and from health resorts could be induced to run ambulance cars, especially adapted to the purpose, a good deal of danger now existing would be done away with. If these ambulance cars would offer to the traveling consumptive only twice the ordinary breathing space, and if the railroad company would be magnanimous enough to have a trained nurse in charge of each car, the accommodations thus offered would be eagerly sought by all invalids; even an additional price would not deter the average patient from making use of this mode of travel, which would certainly lessen to a marked degree the many discomforts from which he has to suffer in the ordinary sleeping car. Wire mattresses, leather cushions, linen curtains, special cuspidors, and linoleum instead of carpets, with better ventilation generally, could make of such a "Pullman" a model ambulance car, easily disinfected, and a credit to the respective company. But a regular, thorough cleaning and disinfection of all passenger cars at stated intervals should be made obligatory.

We now come to the subject of tuberculosis as transmitted from man to man in the ordinary walks of life. As to the mode of transmission there is no longer a doubt; all the circulars issued agree on the fact that the main danger lies in the dried and pulverized tuberculous expectorations; but as to the mode of preventing a tuberculous patient from communicating his disease the recommendations vary. Some are simply impossible to carry out, some are useless, and some not without danger.

It is in a spirit of kindness and in the interest of all that I venture the few following criticisms:

All the circulars issued have already done a great deal of good, but the more practicable and feasible the prophylactic measures recommended therein, the more their usefulness will be increased. Prophylaxis in theory is one thing, but put into practice in everyday life it is another.

In the circular issued by the State Board of Health of California we read as follows: "Persons inheriting the liability to consumption should, above all things, avoid the presence and habitations of persons afflicted with consumption." Now who are the persons inheriting the liability to consumption? They are the sons and daughters of tuberculous parents; and they should, above all things, avoid the presence and habitations of persons afflicted with consumption! If the parents are dead, these children may be able to avoid those afflicted with pulmonary phthisis, but if the parents are living, and especially if in poor circumstances, it will be very difficult, often well nigh impossible, for them to avoid the presence and habitations of the unfortunate ones afflicted with the disease. I am convinced that a practical instruction how to live and remain well, even when obliged to live with consumptives, and even if from tuberculous parentage, would be of more real value. In Europe and in the United States the positions as internes in sanatoriums for consumptives are eagerly sought by many of our unfortunate colleagues who have a hereditary taint, or who have often already developed the disease, and I am glad to say that they often get well in these institutions.

The State Board of Delaware recommends that in case the house has no drain, the contents of the spit-cups be buried in ground that will not soon be turned up. Now Lortet and Despeignes[4] have shown by experiments that the earthworm is instrumental in bringing to the surface the bacilli from buried tuberculous substances, and that the bacillus does not lose its virulence from its sojourn in the earth or in the interior of the earthworm. This mode of disposing of the tuberculous material is then hardly recommendable, and it is certainly not safe for animals to pasture in the vicinity of spots used for the purpose of burying tuberculous expectorations. A previous destruction of the bacilli by boiling or addition of a 5 per cent. carbolic acid solution would certainly be the safer way.

The otherwise excellent circular issued by the State Board of Health of Maine contains exactly the same provision in regard to the sputum of tuberculous patients.

The New Jersey State Board recommends that tuberculous patients should not empty their pocket cups, which are to be carried to receive their expectorations when on the street or when traveling, until boiling water has been poured over the contents, and that the water should be allowed to cool in the cup. What is the poor fellow to do when his little cup is filled and he is still away from home or not in a place where he can procure boiling water to pour over the contents of his cup and wait for it to cool? Even if the water is really boiling the contents of the cup will cool it somewhat, and even a temperature of 100 degrees C. will not kill the bacilli at once. From the experiments of Schill and Fischer[5] one must conclude that it takes at least five minutes of steady boiling to destroy the virulence of the tubercle bacilli contained in fresh sputum. The addition of some some bicarbonate of soda will raise the boiling point to a degree (102 or 103 degrees C.) where the bacilli will be quickly and surely killed.

But all we can reasonably expect of a tuberculous patient is that when he expects to be long away from home, he shall provide himself with a small bottle of carbolic acid, 5 per cent. solution, a small quantity of which he will put in his pocket flask every morning before leaving the house. When it becomes necessary to empty the flask he will do so in the water-closet, or if he is on the street and this is not possible, in the gutter at the mouth of the drain. He will then put another small quantity of carbolic acid in the cup.

In this same New Jersey circular I miss the very important caution about the danger of kissing on the mouth, and that spoons, forks, glasses, napkins, etc., through the medium of the saliva of tuberculous patients may become the vehicles of transmitting the disease.

The Ohio State Board circular on "How to Avoid Consumption" says: "In selecting a mate in marriage choose one free from any inherited scrofulous or tuberculous taint." How many will this deter from marrying whomever they please? And if we could, have we a right to debar an individual with an inherited taint from ever marrying? Have not thousands been cured from such a taint? I would rather say that people who have inherited such a taint can, by a judicious mode of living and with proper medical care, overcome such a condition; but they should never marry until their medical adviser finds them

[4] Lortet and Despeignes: Académie des Sciences, Paris, January 25 and July 4, 1892.

[5] Straus; "La Tuberculose et son Bacille." Paris, 1895.

completely recovered from that peculiar state known as predisposition. I would further plainly state that for people suffering from tuberculosis, or not completely cured, to marry with the idea of raising a family, means in the majority of cases, the rapid shortening of the wife's life and the probable bringing forth of diseased children. A tuberculous mother rarely lives more than a few months after the birth of her child.

At its regular meeting, May 10, 1894, the State Board of Health of Pennsylvania passed the following resolution: "That this board strongly recommends to all local Boards of Health that they require returns of tuberculosis when it has reached the infectious stage, from all physicians and householders, in the same manner that the returns of other infectious diseases are now required." Is tuberculosis not an infectious (*i. e.*, communicable) disease the moment the presence of the bacillus can be demonstrated in the saliva or expectoration? Tuberculosis must be considered a communicable or infectious disease at all times and stages, and the greatest danger from tuberculous patients is at the time when they are still up and around, following their usual vocations but disseminating at the same time through careless expectoration, myriads of bacilli every day, until they become too weak to walk about and are obliged to confine their insanitary habits to one room. If prophylactic measures are to be effectual, they must be instituted at the earliest possible moment in the course of the disease.

In nearly all the movements inaugurated by the State Boards of Health to prevent the spread of consumption, there is a conspicuous lack of regulations concerning hospitals, public or private, which receive tuberculous patients. How necessary such regulations are, I felt when visiting recently an institution in a State where much is done in the direction of prophylaxis. This institution receives nearly 200 patients annually, the majority being consumptives. The following is one of the rules conspicuously posted throughout the house: "Patients must at all times, when in the institution or on the verandas, expectorate in the sputa cups provided. They must never expectorate in the sinks, wash-basins, closets, or on the floor or in their handkerchiefs." Outside the institution the patients are not restricted, they may expectorate wherever they please and I have no doubt they do. I was told that a neighboring farmer who had some time ago bought five healthy cows had them tested recently with the result that three were found tuberculous. I wonder if at times man is not responsible for transmitting his disease to animals.

I may say here, that in nearly all the institutions I visited I noticed the most frequent sanitary defects whenever the institution was without a house physician. It seems to me it should be obligatory for such establishments to provide a resident physician. A minister, matron or a sister superior is hardly the proper person to see that the hygienic and prophylactic demands of modern phthisio-therapy are carried out to the letter.

Well conducted special hospitals for the consumptive poor are the urgent need of all our great cities. Their usefulness would be many times increased if each State would provide a suitable sanatorium for the convalescent and early cases.

The Board of Health of the City of New York has endeavored to inforce registration of all tuberculous cases. The great majority of the profession has opposed any attempt in that direction as untimely. Still, the careless and ignorant consumptives should be controlled and prevented from doing harm by some restrictive measures. The same Board and many other city boards have passed ordinances forbidding expectorating in street cars or on the floors of public buildings, and some even make it punishable to expectorate in the street. But any one who observes at all will be surprised to note how little these ordinances are heeded.

Fig. 1.—Dr. Knopf's modified pocket flask for tuberculous patients.

But do we ever think how really hard it is for a naturally sensitive consumptive to be a law-abiding citizen in this respect? Not to expectorate on the floor or in a handkerchief, but to attract the attention of everybody to his infirmity by his peculiar mode of disposing of his expectorations? Try it once yourself. I occasionally carry a pocket flask and expectorate intentionally therein when riding in the street cars. I wish you could see the eyes sometimes turned on me. And still, I think a more universal use of the pocket flask, not only if we are tuberculous, but also when we have a simple cold, would solve the problem of promiscuous spitting in public and in private.

Fig. 2.—Dr. Dettweiler's "Hustenflaeschchen."

The use of the handkerchief for the purpose of expectorating, while better than spitting on the floor, is certainly not very sanitary, and I have no doubt, at times, is the cause of a severe reinfection of the nasal mucous membrane. And I really do not see anything

unesthetic in the discreet use of a neat pocket flask, such for example as the one you see here.

It is a modification of Dettweiler's celebrated "Hustenflaeschchen," which I also show you.

My flask differs from Dettweiler's inasmuch as it is made of aluminum instead of glass, weighs two ounces instead of six, is of two pieces instead of three and is not patented. It is unbreakable and easily cleaned. Like Dettweiler's, it is constructed on the principle of the irreversible inkstand. It has a nearly uniform

Fig. 3.—Dr. Predoehl's spittoon for factories and workshops.

diameter of one and three-fourths inches and is about four inches long. It is less bulky than the oval glass flask. Since we must consider the proper spittoon, properly placed, as an important factor in the prophylaxis of tuberculosis, allow me to present you with two drawings, one showing Predoehl's practical cuspidor of enameled iron for factory and workshop use, which can be attached to any height, and the other my own elevated spittoon for hospitals or sanitariums, only visible when in use.

Fig. 4. Fig. 4a.

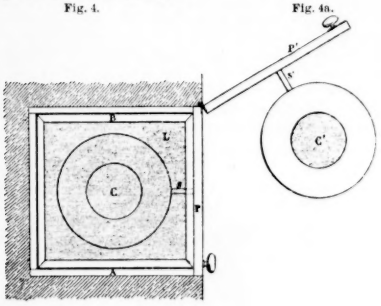
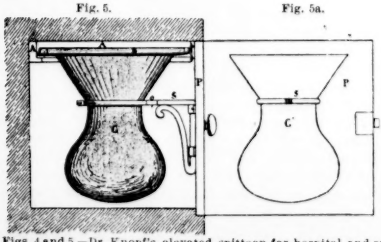


Fig. 5. Fig. 5a.



Figs. 4 and 5.—Dr. Knopf's elevated spittoon for hospital and sanatorium use. Spittoon elevated 3 or 3½ feet from the floor and inclosed in the wall. F, door; S, hinged support; C, spittoon; B, cover. Figs. 4 and 4a, plan; 5 and 5a, elevation. Figs. 4 and 5 represent the door closed; 4a and 5a represent the door open.

Our dispensaries should be supplied with pocket flasks to be distributed gratuitously, or at cost price, to all coughing patients, with instructions for using them.

At the close of my criticism, I have but two more suggestions to offer, the more universal instruction in public schools in physical exercises, breathing exercises especially, and lessons how not to become consumptive and lessons on hygiene in general; and lastly, the creation of a National Board of Health, the equivalent of the "Deutsche Reichsgesundheitsamt" of Berlin or the "Direction d'Hygiène Publique" of Paris with its "Comité Consultatif" under the direction of the Minister of the Interior. Such an institution, with its seat at Washington, could give uniform hygienic laws, and being counseled by the most competent in the profession, would aid us best in our struggle against this most deadly of all diseases. By requiring health officers all over the United States to take a course in practical hygiene, it would give a great impulse to sanitary science. We might then hope for effective work, and for thorough and feasible methods to combat tuberculosis in man and beast through the length and breadth of our beautiful land.

955 Madison Avenue.

THE PRESENT ATTITUDE OF SANITARIANS AND BOARDS OF HEALTH IN REGARD TO PULMONARY TUBERCULOSIS.

Presented in the Section on State Medicine, at the Forty-eighth Annual Meeting of the American Medical Association, held at Philadelphia, Pa., June 1-4, 1897.

BY BENJAMIN LEE, A.M., M.D., PH.D.
PHILADELPHIA, PA.

The question of the communicability of pulmonary tuberculosis, consumption of the lungs or pulmonary phthisis, has long passed the boundary of discussion with the great mass of the medical profession.

Here and there an individual who places a very high estimate on his reputation for consistency persists in attempting to controvert it, because it was not the belief in which he was educated, and because he opposed it when, in consequence of the researches of the bacteriologic investigators, it was first resuscitated. But, in the main, the consensus of professional opinion strongly supports it. Those who take an intelligent interest in the promotion of public health and have thus been led to give the subject more especial attention are even more thoroughly convinced of the fact than are those who confine their studies strictly to therapeutics and the daily routine of practice; while those whose official positions make it their duty to do all in their power to extinguish disease, diminish the death-rate, and promote longevity, entertain convictions so positive as to lead them to believe in the possibility of the adoption of measures which shall restrict the spread of the disease and thus add an incalculable number of years to the aggregate of human life. Holding such convictions they would be false to their consciences and to their official oaths did they hesitate to formulate such measures and to urge their adoption on the law-making power. Such efforts of course provoke opposition, and the form which that opposition takes is that of attempting to create a public sentiment averse to the adoption of any restrictions whatever by misrepresenting the character of the regulations proposed and magnifying the discomforts and

annoyances which would result from their enforcement. Even if the proposed measures were as unwise and as rigorous as they have been distorted into appearing, I doubt if any one is so bold as to deny that they should be adopted, if there be reasonable ground to hope that by such means, and by no others, could the terrible ravages of this affection be materially checked. Fortunately, however, these are not the views of sanitarians and of boards of health.

The more carefully the mode of propagation of the disease is studied the simpler becomes the problem of its legal restriction. No Board of Health, so far as I know, has promulgated the dogma attributed to those who are in favor of giving the knowledge which we now possess a legal expression that shall make it of use to the community, that "these unfortunates should be isolated from family or friends and treated as creatures disseminating a contagious disease, like smallpox, yellow fever, scarlet fever or diphtheria." What then can sanitary authorities do, and what do they propose to do, to diminish the prevalence of consumption and therefore all forms of tuberculosis, whether attacking the pulmonary or other tissue of the body?

1. They can and should formally and publicly announce their belief that, after a certain stage of tubercular phthisis has been reached, namely, that of softening, breaking down or suppuration, the individual affected becomes a source of danger to those immediately surrounding him and to the public, and of infection of material objects, such as walls, bedding and furniture.

2. They can and should formulate and disseminate as widely as possible, simple, concise instructions as to the precautions which such patients should themselves take in order to prevent or minimize these dangers.

3. They can and should have a knowledge of every case of consumption which has reached the stage referred to, existing within the limits of their respective jurisdictions and, as this information can be obtained in no other way, they can and should require physicians to report to them all such cases occurring in their practice, whether privately or in public institutions, within a certain definite time after the diagnosis had been established.

4. They can and should offer to aid the physician in any case where he is doubt, by affording facilities for the bacteriologic diagnosis of the disease.

5. They can and should insist on the disinfection, by such means as they deem most effective, of every apartment from which such a patient has been removed, whether by death or otherwise.

6. They can and should insist on the disinfection of berths and state rooms in public conveyances, whether on land or water, in which such patients have passed one or more nights.

7. They can and should in every possible way disseminate information as to the dangers arising from the habit of spitting in public places and especially on the floors of public conveyances, whether on land or water.

8. They can and should formulate municipal ordinances and State laws for the restriction of this dangerous habit and urge the passage of the same.

The following are copies of resolutions and an ordinance framed with this object, by the Board of Health of the City of Philadelphia, and presented to the councils but not yet adopted:

WHEREAS, The habit of spitting in frequented public places, particularly when such places are enclosed, is not only uncleanly and unnecessary, but prejudicial to health; and

WHEREAS, It is proved that certain diseases, as consumption, are mostly propagated by dried expectorations, and for this reason alone should be condemned; it is therefore

Resolved, That city councils be respectfully requested to cooperate with the Board of Health in their endeavors to restrict, if not prevent, this pernicious habit, and they are hereby earnestly solicited to pass the following ordinance, not only to promote cleanliness, but to safeguard the public health:

An Ordinance Forbidding Spitting in Public Buildings and Passenger Railway Cars.

WHEREAS, Spitting in public building and passenger railway cars has been declared by Boards of Health of different cities in the United States to be prejudicial to the health of the people who visit such buildings or ride in such cars; and

WHEREAS, This practice is not only unhealthy, but uncleanly, offensive and filthy, and injurious to wearing apparel, especially of women, and therefore, a common nuisance; therefore

SECTION 1. The Select and Common Councils of the City of Philadelphia do ordain: That spitting upon the floors of public buildings and of passenger railway-cars is hereby declared to be a nuisance and prejudicial to health, and is hereby prohibited under a penalty of $5 for each and every offense, to be recovered as penalties of like amount are by law recoverable."

The value of such an ordinance as an education would be even greater than that which it would possess in the direct restriction of disease.

9. They can and should do all in their power to promote the establishment of hospitals and sanatoria for consumptives both by State and municipal authorities, with large provision for such persons as are unable for pecunary reasons, to avail themselves of such refuges already established by private enterprise. This measure should be urged not on the score of humanity or charity, but simply as the most effective means of protecting the public health, so far as the spread of tuberculosis is concerned, that has yet been devised. There would be no necessity for dragging these unfortunates from their families and homes to place them in such institutions. There are multitudes waiting for just such opportunities, who would be only too glad to embrace them.

10. They can and should do all in their power to promote such legislation as would ensure the systematic inspection of dairies and dairy-farms, in order that all cattle giving evidence in any way of being affected with tuberculosis may be at once isolated and the quarters which they occupied thoroughly disinfected.

It will be gathered from this hasty résumé of the responsibilities which health authorities feel to be resting upon them in this regard, that it is by no means contemplated to use the same precautions and restrictions for consumption, such as placarding or guarding houses, and isolating patients, as are in force for smallpox and diphtheria.

Section 225, of the Sanitary Code of the City of New York adopted in January of the present year, may be fairly taken as an exponent of the general feeling of sanitary officials on this subject. It read as follows:

That pulmonary tuberculosis is hereby declared to be an infectious and communicable disease dangerous to the public health. It shall be the duty of every physician in this city to report to the Sanitary Bureau in writing, the name, age, sex, occupation and address of every person having such disease who has been attended by or who has come under the observation of such physician for the first time, within one week of such time. It shall also be the duty of the commissioners or managers or the principal, superintendent or physician of each and every public or private institution or dispensary within this city, to report to the Sanitary Bureau in writing, or to cause such report to be made by some proper and competent person, the name age, sex, occupation and last address of every person

afflicted with this disease who is in their care or has come under their observation within one week of such time. It shall be the duty of every person sick with this disease and of the authorities of public and private institutions or dispensaries, to observe and enforce all the sanitary rules and regulations of the Board of Health for preventing the spread of pulmonary tuberculosis.

(L. S.) CHARLES G. WILSON, President.
EMMONS CLARK, Secretary.

It will be observed that this regulation limits itself to declaring that pulmonary tuberculosis is an infectious and communicable disease, to requiring its occurrence to be reported, and to insisting on the observation of the precautions of the Board for preventing the spread *not of the acute contagious diseases*, but of this one particular disease.

The nature of these precautions may be gathered from the following circular of the Board, entitled "Information for Consumptives and Those Living with Them."

HEALTH DEPARTMENT, CRIMINAL COURT BUILDING, CENTER, WHITE, ELM AND FRANKLIN STREETS, NEW YORK.

Consumption is a disease which can be taken from others and is not simply caused by colds. A cold may make it easier to take the disease. It is usually caused by germs which enter the body with the air breathed. The matter which consumptives cough or spit up contains the germs in great numbers; frequently millions are discharged in a single day. This matter, spit upon the floor, wall or elsewhere, is apt to dry, become pulverized and float in the air as dust. The dust contains the germs, and thus they enter the body with the air breathed. The breath of a consumptive does not contain the germs and will not produce the disease. A well person catches the disease from the consumptive only by in some way taking in the matter coughed up by the consumptive.

Consumption can often be cured if its nature is recognized early and proper means are taken for its treatment. *In a majority of cases it is not a fatal disease.*

It is not dangerous for other persons to live with a consumptive, if the matter coughed up by the consumptive is at once destroyed. This matter should not be spit upon the floor, carpet, stove, wall, or anywhere except into a cup kept for the purpose. The cup should contain water so that the matter may not dry, and should be emptied into the closet at least twice a day and carefully washed with hot water. Great care should be taken by a consumptive that his hands, face and clothing do not become soiled with the matter coughed up. If they do become soiled they should be at once washed with hot soap and water. When consumptives are away from home, the matter coughed up may be received on cloths, which should be at once burned on returning home. If handkerchiefs are used (worthless cloths which can be burned are far better), they should be boiled in water by themselves before being washed.

It is better for a consumptive to sleep alone, and his bedclothing and personal clothing should be boiled and washed separately from the clothing belonging to other people.

Whenever a person is thought to be suffering from consumption, the name and address should be at once sent to the Health Department, on a postal card with a statement of the facts. A medical inspector from the Health Department will then call and examine the person to see if he has consumption, providing he has no physician, and, if necessary, will give proper directions to prevent others from catching the disease.

Frequently a person suffering from consumption may not only do his usual work without giving the disease to others, but may also get well if the matter coughed up is properly destroyed.

Rooms that have been occupied by consumptives should be thoroughly cleaned, scrubbed, whitewashed, painted, or papered before they are again occupied. Carpets, rugs, bedding, etc., from rooms which have been occupied by consumptives, should be disinfected. The Health Department should be notified, when they will be sent for, disinfected and returned to the owner free of charge, or, if he so desires, they will be destroyed.

By order of the Board of Health,
CHARLES G. WILSON, President.
EMMONS CLARK, Secretary.

The State Board of Health of Pennsylvania has contented itself, so far, with adopting a resolution advising all local boards to place tuberculosis on the list of communicable diseases, to be reported, and issuing a precautionary circular for the information of local boards, and also of those who may be suffering from the disease. By such sufferers these circulars are, as a rule, gratefully received. This circular is No. 28, entitled "Precautions Against Consumption" and treats of the history and nature of the disease; how the disease is spread or acquired; precautions with regard to cattle; precautions to be observed by the patient; disease germs; precautions to be taken in the sick-room; precautions to be taken after the death of the patient; and precautions to be taken by the proprietors of public houses and public conveyances.

THE ANTITOXIC AND BACTERICIDAL PROPERTIES OF THE SERUM OF HORSES TREATED WITH KOCH'S NEW TUBERCULIN.

Read at the Twenty-third Annual Meeting of the Mississippi Valley Medical Association, held at Louisville, Ky., Oct. 5-8, 1897.

BY CARL FISCH, M.D.
ST. LOUIS, MO.

All attempts at establishing a serotherapy in tuberculosis have hitherto failed, that means, if we understand by serotherapy a specific prophylactic or curative treatment, like the one established in diphtheria or tetanus. So decided and pronounced has this failure been that in the mind of many observers a strong prejudice has been created, a prejudice that appears the more justifiable since commercialism has not hesitated in exploiting so promising a field. We would however be very hasty in drawing from these failures the conclusion that serotherapy in consumption is not a thing to be hoped for, as has been done by many writers. We can not be too chary in making final statements, a postulate that at this very time emphasizes itself with particular weight by the discovery made by Kitasato of an antitoxic typhoid serum. Has it not been for some time past one of our axioms, that in typhoid and cholera only bactericidal and no antitoxic properties were developed? The less we try to encase new ideas, and serotherapy is a new idea, in the forms of old conceptions, the less frequently we will have to retrace our steps. No metewand has as yet been discovered to point out the limits and boundaries of this new idea; whoever talks about the limits of serotherapy confesses that he does not or will not understand its origin.

For these very reasons it is an unpromising task to foretell by logic reasoning, whether or to what degree serum treatment will influence tuberculosis. Nobody ever expected that it would bring about a *restitutio ad integrum* in advanced cases, or redress the ravages of septic complications. It is certainly absolutely erroneous to insist that the anatomo-pathologic phenomena of pure tuberculosis, are not indicative of a toxic process which might be amenable to antitoxic impressions. Such intoxication exists from the very first hour, I might say, of the beginning of tuberculous infection, a fact that is not only evidenced by histologic changes, but that can also be proven by physiologic reactions. To say that the early tuberculous changes are simply of an inflammatory character expresses only a morphologic phenomenon. Physiologically they are as pronouncedly caused by bacterial toxins as are any other bacterial intoxications. It is true this toxic inflammatory process is little noticeable in its early stages and becomes mostly chronic, gradually undermining the vital vigor and leading to

fatal loss of substance or secondary infections (in fact, very few persons die of chronic tuberculosis), but in this very chronicity the battle waged between the human organism and the array of bacterial toxins expresses itself; very often the former remains victorious perhaps in a majority of cases. In our language such a victory means immunization although only for the time being.

It is not here the place to enter more fully into these exceedingly interesting questions. I had to touch upon them because it has ever and again been contested that theoretically there were no prospects for serotherapy in this disease. Valuable remarks regarding this topic may be found in an able paper of Joseph McFarland.[1]

But we would be wrong if we attributed this reserve to well conceived and understood pathologic considerations alone; behind them there lurks a preconceived idea of self-limitedness, and above all a mysterious predisposition for the disease. This hereditary predisposition would be well worth to be looked into a little more thoroughly; I can not do it here, and must confine myself to the statement that a scientific base for the tubercular predisposition still is wanting.[2]

Not mentioning those attempts at putting forth an antitubercular serum that were only prompted by mercenary motives, the number of honest workers in this field is quite large. Since Richet and Hericourt first began their experiments an enormous amount of persevering and unselfish work has been done. I will only mention the names of Courmont, Babes, Niemann, Maragliano, Schweinitz, etc. Admitting that there are considerable differences between the several methods employed by these investigators, entering into which would lead us too far here, there is one source of error common to all, that is the material used for immunizing the animals which were used for the purpose. If we look over the laborious experiments of Koch to establish immunity by means of tubercle bacilli or of their products, we find that the chief difficulty was to cause the tubercle bacilli to be absorbed by the tissues or to chemically so act on the bacilli that their immunizing ingredients were contained in a fluid extract. The peculiar morphologic and chemic constitution of the tubercle bacilli made, indeed, all these experiments unsuccessful. Koch had finally to destroy the morphologic entity of the bacilli in order to obtain unobjectionable results. In other words the essential toxins (some writers it is true, assert that there are no essential tubercle toxins) are not excreted like they are in cultures of diphtheria bacilli, but they are to the far greatest extent enclosed within the membrane of the bacterial cell. The culture fluids contain none, or very little of these specific toxic substances; they may be injected in comparatively large doses into animals without causing serious damage.[3] We may add right here that it seems that there are produced a number of different toxic substances, at least this would best explain the contradictory results of some observers; but we must not forget that ferments or enzymes, like the bacterial toxins, are very unstable compounds and are easily changed in their chemic nature by all kinds of artificial procedures. It is, therefore, more than likely that the different bodies isolated from tubercle bacilli or their culture media, are not pre-existing, but represent ingredients of the former in a changed form.

Surely this holds good for the old tuberculin, which has mostly been used as an immunizing agent. How little this fluid represents the active principles of the live tubercle bacillus is well illustrated by the following observation. If some of the dead and extracted bacilli which remain as residue after the preparation of tuberculin are injected into suitable animals, they not only cause the formation of typical tubercles, but even prompt these animals to yield a typical tuberculin reaction. It is well known, furthermore, that this tuberculin reaction, the nature of which has by no means as yet been explained, may be obtained by several other similar bacterial compounds (proteins) and even by heterogeneous albuminous bodies (deutero-albumoses). No matter in which way the tuberculin was prepared it is *a priori* impossible that the serum of animals immunized against it possesses any antitoxic properties as far as the tuberculosis *toxins* are concerned. A certain antituberculinic power may be exhibited by it (this is apparent especially by experiments made by Schweinitz[4], Babes[5] and others), and by it some influence on tuberculous processes may be now and then explained. In general, the results obtained with such a serum have been discouraging. The same obtains for those modifications of antitubercular sera, for the preparation of which in addition to tuberculin cultures of the bacilli, dead or alive, have been utilized. As said above these bacilli are very slowly resorbed, the greater part of them is ejected in the pus of abcesses formed at the site of the injection. It must not be denied, however, that in some instances the results thus reached were fairly promising. This refers especially to the work of Niemann[6] and Babes[7], who really repeatedly immunized guinea pigs in this way against inoculation with living bacilli. This proves that the serum prepared by them possessed distinct antitoxic (according to Babes even bactericidal) properties. But they also operated only with a part of the active principles of the tubercle bacillus, and accordingly the outcome of their labors lacks consistency and certainty. In no case out of the great number of respective investigations was a stage reached in which the observer could with certainty foretell the result of an experiment.

That both antitoxic as well as bactericidal potencies must be qualities of an antitubercular serum, is shown by the well-known phenomenon that we sometimes have to deal with an infectious, mostly with a toxic type of the disease; that living bacilli, furthermore, as such are less apt for the production of such a serum than dead ones (that means bacilli easier accessible to disintegrating influences) is indicated by the enormously larger toxicity of dead bacilli[8]. It may be well in this connection to mention the important fact that from the tuberculous organs of infected animals an extract can be prepared, that while being exceedingly toxic when injected in gradually increasing doses into guinea pigs, in a short time immunizes them against the introduction of virulent cultures[9].

If so it goes without saying that "antituberculin sera" are not what must be claimed from an antitubercular serum; there are certain direct drawbacks attached to them, that under circumstances have proved very obnoxious. In the first place the assimilation of the tuberculin by the animal organism is a slow process; it may happen that the serum of these animals contains unchanged tuberculin instead of antituberculin. The following experiment illustrates this fact: A healthy guinea pig received in seven doses during twenty days as much as 10 c.c. of tuberculin. Ten days after the last injection some blood was drawn

from this animal; 1 c.c. of the serum of this blood was sufficient to produce a typical and very violent tuberculin reaction in a tuberculous guinea pig. This phenomenon is at the bottom of what in the literature is known as transmitted tuberculin-action. Its undesirability is evident.

TABLE 1.—Influence of T.R. serum on the temperature of healthy guinea pigs.

Date.	Number of guinea pig.	Weight in grams.	Amount of serum injected.	Temper. before injection.	Three hours later.	Six hours later.	Nine hours later.	Twelve hours later.
July 16. . .	52	750	0.25 c.c.	101.6	100.8	101.0	101.2	101.5
July 16. . .	53	640	0.50 c.c.	102.1	101.0	101.5	101.8	102.2
July 16. . .	54	680	1.00 c.c.	101.8	101.2	101.2	101.4	101.6
July 16. . .	56	706	2.00 c.c.	101.7	100.6	100.8	101.0	101.6

TABLE 2.—Effect of normal horse serum on the temperature of healthy guinea pigs.

Date.	Number of guinea pig.	Weight in grams.	Amount of serum injected.	Temper. before injection.	Three hours later.	Six hours later.	Nine hours later.	Twelve hours later.
July 17. . .	55	714	0.50 c.c.	102.2	101.6	101.6	102.0	102.4
July 17. . .	57	685	1.00 c.c.	102.4	101.3	101.6	102.4	102.2

TABLE 3.—Guinea pigs, after previous immunization with T.R. serum, inoculated with a fatal dose of tubercle bacilli.

No.	Weight July 5.		Weight Aug. 3.	Inoculated with fatal dose of T.B., Aug. 3.	Weight Sept. 20.	Remarks.
17	850	Received 1.25 c.c. serum in 0.25 c.c. doses, from July 5 to Aug. 3.	867	Subcutan.	880	Sept. 20, perfectly healthy.
20	740		748	Subcutan.	764	Sept. 20, perfectly healthy.
21	874		883	Intraperi'l	888	Killed Sept. 20. No lesions.
24	560		571	Not inocul	588	Healthy.
25	674		692	Not inocul	712	Healthy.
22	. .		721	Subcutan. . .	. .	Died Aug. 27.
23	. .		856	Subcutan. . .	. .	Died Aug. 24.

TABLE 4.—Immunization experiment 1.25 c.c. serum T.R.

No.	Weight July 5.		Weight Aug. 3.	Fatal dose of T.B. Aug. 3.	Weight Sept. 20.	Remarks.
18	716	Received 1.25 c.c. in 0.25 c.c. doses from July 5 to Aug. 3.	724	Inoculated	723	Extensive infiltration.
19	635		688	Inoculated	656	Extensive infiltration.
27	560		575	Inoculated . .		Died Aug. 23.
58	612		621	Not inocul	629	. . . . .
59	461		468	Not inocul	476	. . . . .

TABLE 5.—Immunization experiment 2.5 c.c. of serum.

No.	Weight July 5.		Weight Aug. 3.	Fatal dose T.B.	Weight Sept. 20.	Remarks.
60	672	From July 8 to Aug. 3, 5 injections of 0.5 c.c. each.	675	Inoc. Aug. 3.	677	Perfectly healthy.
61	457		471	Inoc. Aug. 3.	475	Perfectly healthy.
62	489		496	Inoc. Aug. 3.	501	Perfectly healthy.
63	723		729	Not inocul'd	738	Perfectly healthy.
64	594		617	Not inocul'd	629	Perfectly healthy.

TABLE 6.—Serum and virus injected (mixed).

No.	Weight July 14.	Mode of inoculation.	Weight Sept. 16.	Remarks.
1	456	T.B. and ½ c.c. ser. subcut.	469	Healthy.
2	567		581	Healthy.
37	496		517	Healthy.
38	712		730	Healthy.
39	591	T.B. and ½ c.c. ser. intraper.	612	Healthy.
65	623		627	Healthy.
66	720	T.B. and 1 c.c. ser. subcut.	731	Healthy.
67	635		649	Healthy.
68	587		610	Healthy.
69	421	T.B. and 0.25 c.c. ser. subcut.	437	Healthy.
70	566		575	Healthy.
71	578		592	Healthy.
72	703	T.B. and 0.1 c.c. ser. subcut.	. .	Died August 20.
73	627		584	Large infiltration.
31	651	Fatal dose T.B. alone.	. . . .	Died Sept. 6.
32	561		. . . .	Died August 7.
33	622		. . . .	Died August 3.
34	786		. . . .	Died August 12.
35	612	T.B. and 0.25 c.c. Paquin's ser. subcut.	. . . .	Died August 5.
36	659		. . . .	Died August 1.
37	477		. . . .	Died July 30.

TABLE 7.—Serum and virus injected separately.

No.	Weight July 19.	Mode of inoculation.	Weight Sept. 12.	Remarks.
11	425	T.B. and 0.25 c.c. serum.	489	Healthy.
12	553		576	Transitory gland. enlargement.
13	496		519	Healthy.

TABLE 8.—Treatment begun four days after inoculation.

No.	Inoculated with fatal dose of TB.	Weight July 20.	Begin. of serum injection 0.25 c.c. every other day.	Weight Sept. 24.	Remarks.
4	July 20. . . .	560	July 24	572	Perfectly healthy.
5	July 20. . . .	544	July 24	548	Perfectly healthy.
6	July 20. . . .	489	July 24	500	Perfectly healthy.
30	July 20. . . .	621	July 24	629	Perfectly healthy.
40	July 20. . . .	576	July 24	587	Perfectly healthy.
41	July 20. . . .	611	July 24	619	Perfectly healthy.

TABLE 9.—Treatment begun seven days after inoculation.

No.	Inoculated with fatal dose of TB.	Weight July 20.	Begin. of serum injection 0.25 c.c. every other day.	Weight Sept. 24.	Remarks
7	July 20. . . .	476	July 27	482	Healthy.
8	July 20. . . .	496	July 27	503	Healthy.
9	July 20. . . .	521	July 27	536	Healthy.
10	July 20. . . .	546	July 27	550	Healthy.
11	July 20. . . .	488	July 27	499	Healthy.
12	July 20. . . .	517	July 27	529	Healthy.

TABLE 10.—Treatment begun ten days after inoculation.

No.	Inoculated with fatal dose of TB.	Weight July 21.	Begin. of serum injection 0.25 c.c. every other day.	Weight Sept. 24.	Remarks.
13	July 21 . . .	610	July 31	612	Healthy.
14	July 21 . . .	528	July 31	529	Healthy.
15	July 21 . . .	477	July 31	479	Swelling of inguinal glands.
16	July 21 . . .	531	July 31	534	Healthy.
17	July 21 . . .	601	July 31	. .	Killed Sept. 3.
18	July 21 . . .	576	July 31	. .	Killed Sept. 3.

TABLE 10a.—Treatment begun fourteen days after inoculation.

26	July 21 . . .	525	Aug. 3.	456	Glandular swell'g, ulceration.
28	July 21 . . .	614	Aug. 3.	. .	Died Sept. 4.
29	July 21 . . .	539	Aug. 3.	474	All signs of tuberculosis.

TABLE 10b.—Controls; not treated.

42	July 21 . . .	507	Not treated.	. .	Died Aug. 15.
43	July 21 . . .	563	Not treated.	. .	Died Aug. 18.
44	July 21 . . .	492	Not treated.	. .	Died Aug. 11.

TABLE 10c.—Controls; treated with Paquin's serum.

45	July 21 . . .	516	July 25	. .	Died Aug. 13.
46	July 21 . . .	476	July 25	. .	Died Aug. 14.
47	July 21 . . .	567	July 25	. .	Died Aug. 10.

TABLE 11.—Showing effect of tuberculin injection after six weeks of treatment.

No	Date of injection of 0.1 tuberculin.	Temper. at time of injection.	Three hours later.	Six hours later.	Nine hours later.	Twelve hours later.	Fifteen hours later.	Eighteen hours later.
13	Sept. 12, 10 A.M.	101.8	101.9	101.8	102.1	101.8	102.0	101.6
14	Sept. 11, 2 P.M.	102.3	102.2	102.0	102.4	101.8	101.9	102.2
16	Sept. 14, 8 A.M.	102.0	102.0	102.0	102.2	102.0	102.2	102.4

TABLE 12.—Showing the effect of serum treatment on the temperature. First injection July 31, 12 A.M.

No.	July 29, 8 A.M.	July 29, 8 P.M.	July 31, 8 A.M.	July 31, 8 P.M.	Aug. 1, 8 A.M.	Aug. 1, 8 P.M.	Aug. 3, 8 A.M.	Aug. 3, 8 P.M.	Aug. 5, 8 A.M.
13	103.6	104.4	104.0	103.6	103.0	102.6	101.8	102.2	101.6
14	104.2	104.8	103.8	103.0	102.2	102.6	102.0	102.4	102.0
16	104.6	105.2	104.8	104.0	103.2	101.8	102.4	102.0	102.2

TABLE 13.—Test for bactericidal property of the serum.

Contact between TB and serum lasted hours.	1 c.c. of the T.B. Serum mixture injected intraperitoneally into guinea pig.	Date of injection.	Weight Sept. 20.	Remarks.
1	48 (weight 520)	August 5.	. . .	Died Aug. 21.
2	49 (weight 486)		. . .	Died Aug. 17.
3	50 (weight 573)		. . .	Died Aug. 20.
5	51 (weight 507)		516	No signs of disease.
8	74 (weight 495)		519	Healthy.
12	75 (weight 475)		489	Healthy.
24	76 (weight 503)		517	Healthy.

TABLE 14.—Inhibition of tuberculin reaction by means of 0.1 c.c. serum.

Number of guinea pig.	Injected with.	Temper. before injection.	3 hours later.	6 hours later.	9 hours later.	12 hours later.	15 hours later.	18 hours later.
74. Tuberculous for 2 weeks.	0.1 tuber. and 0.1 serum.	103.9	103.8	104.0	103.6	103.8	104.1	103.9
75. Tuberculous for 3 weeks.	0.1 tuber. and 0.1 serum.	102.4	102.6	102.4	102.8	102.2	102.6	102.4
76. Tuberculous for 10 days.	0.1 tuber. and 0.1 serum.	103.2	103.4	103.4	103.2	103.6	103.0	103.0
77. Tuberculous for 2 weeks.	0.1 tuberc.	103.0	103.0	103.6	104.2	104.8	104.6	103.8

TABLE 15.—Repeated *toxin* reaction in the same animal.

No. of guinea pig.	Injected with	Date of injection.	Temper. before injection.	3 hours later.	6 hours later.	9 hours later.	12 hours later.	15 hours later.	18 hours later.
78. Tubercul. for about 20 days	1. c.c. toxin	9- 1	102.8	103.8	104.2	104.3	104.6	104.2	103.8
79. Tubercul. for 16 days	"	9- 1	103.2	104.4	105.0	104.8	104.8	104.2	103.6
78.	"	9- 4	103.0	104.6	105.4	105.0	105.2	104.2	103.8
79.	"	9- 4	102.6	103.8	104.6	104.4	104.4	104.0	103.6
78.	"	9- 8	103.4	104.8	105.6	105.2	105.4	104.8	104.0
79.	"	9- 8	102.8	104.2	104.4	104.8	105.0	104.6	104.0
78.	"	9-11	102.6	104.0	104.6	104.4	104.0	104.2	103.6
79.	"	9-11	103.4	104.4	104.8	105.0	105.0	104.2	103.6
78.	1.5 c.c. toxin	9-14	102.4	104.8	104.8	105.0	104.6	104.4	103.6
79.	"	9-14	103.2	104.2	104.6	104.8	104.2	104.0	103.0
78.	"	9-17	103.0	103.8	104.2	104.8	104.6	104.0	10.40
79.	"	9-17	102.4	103.6	103.8	104.6	104.2	104.0	103.4

Again, it is little known that bacterial proteins in glycerinic extracts, when administered for any length of time, invariably tend to produce a chronic nephritis. Niemann[10] first called attention to this fact, and I found it confirmed in two horses which for some months had been treated with high doses of tuberculin. It is not impossible that the fatal effects, which these sera sometimes have on animals, are due to uremic products retained in the blood serum. Babes[11] saw guinea pigs die from the injection of 0.5 c.c. of such a serum; Rutkowski[12] relates similar accidents in his report on Vicquerat's antitubercular serum. I myself saw repeatedly guinea pigs die in a very short time from the injection of 0.5 to 1 c.c. of Paquin's serum. The autopsy (death in diastole) did not reveal any definite cause of death.

The foregoing somewhat lengthy remarks were necessary in order to show that the solution of the tuberculosis serum problem depended upon the discovery of some means of making the tubercle bacilli with all their constituents easily resorbable. I did not fail at once to see that with Koch's new tuberculin, T. R.,[13] this means was given, and immediately set to work to follow out this idea. But I would not like to be understood as if this work claimed to be something original; logically the thought was bound to offer itself, and in addition to this, Koch himself had insinuated it. While my experiments were going on, I had the satisfaction to hear that Behring[14] was following the same lines, though no details whatsoever about his investigations have as yet reached this country.

It need not concern us here that at the present time a hot war is raging as to the therapeutic value of this new tuberculin; in contradistinction to other observers,[15] I can confirm Koch's statement about its immunizing properties toward animals. But the salient point was that at last in it we had a substance which exhibited, in full and unchanged, all of the toxic ingredients of a tubercle bacillus. We have seen before that the culture media of tuberculosis cultures contain only a very small amount of toxic bodies, most likely the outcome of disintegration of the bacilli.[16]

If, therefore, a conclusion *per analogiam* was allowed, this new tuberculin (T. R., I shall henceforth call it), by immunizing animals was likely to produce the desired antitoxic effects, if such effects could be obtained altogether. Within the limits of our present knowledge no other means of doing this could be conceived.[17] I began experiments in this direction, and the following remarks will give their results:

According to Koch's directions, a greater part of the tuberculous toxins is excluded under the name T. O.; this T. O. contains those toxins that are contained in the adhering traces of culture media, as well as those that easily are extracted from the membranes of the bacilli. They do not seem to have a great immunizing power, but are exceedingly toxic and resemble in their effects, in many regards, the old tuberculin. But try as I might, I could not convince myself as to the logical necessity to exclude this part of the toxins from the immunizing process, so much the less since in my animals I did not need to be afraid of any, and even very severe, reactions. The same, I thought, applied to the fraction of toxic substances contained in the culture media. To express myself candidly, I did not want to take any chances in omitting some toxic body that afterward perhaps might prove of intrinsic value, although I knew that T. R. alone would immunize my animals against these substances. I used only strong and perfectly healthy horses.[18]

The way in which I proceeded may be described as follows: I began with the injection of 1 c.c. of T. R., which did not cause any reaction whatsoever; in the subsequent injections, which were made about every seven and ten days, the amount was about doubled each time until 30 c.c. of pure T. R. were reached. The reactions so far were very slight, the temperature never rising more than 1.5 degrees F. At this stage I commenced adding small amounts of T. O., as well as an aqueous extract of the nutrient agar; the reactions were very severe, sometimes reaching perfect prostration. Mostly a profuse diarrhea set in; after a temporary fall the temperature rose to 104 and 105 degrees F. Loss of appetite occurred, etc. In four or five days these symptoms disappeared. Sometimes abscesses formed, caused by some undestroyed tubercle bacilli. Gradually and cautiously I reached a combined dose of 75 c.c. of T. R. and 30 c.c. of T. O. The indications are, however, that much higher amounts will be tolerated, and I do not propose to stop before external reasons call for a halt. Both preparations, T. R. and T. O., were prepared in my laboratory, and the culture I used was of such a virulence that the *dosis minima*, when injected into the abdominal cavity of a guinea pig (about 500 grams), killed the animal within ten to fifteen days. As *dosis minima* I came to consider one loopful of an emulsion obtained by thoroughly triturating one loopful (1 mg.) of a four weeks agar culture with 1 c.c. of sterilized water. Smaller doses produced a protracted course of the disease; the latter then invariably attacked the lungs. The toxic power of this culture was so great that about 16 mg. of the dried and finely triturated bacilli killed, within twenty-four hours, guinea pigs of the above average weight. Therefore, if with Behring we call *m* the fatal dose of toxin for one gram of guinea pig, my culture possessed a toxicity of 30,000 t. m. I tested its toxicity during several generations, but did not find any material deviations. Cultures of a different origin showed only a potency of 400 and 2,000 respectively. A culture of

aviary tuberculosis goes as low as 260. We must not lose sight of the fact that these figures only hold good for guinea pigs.

The first blood was drawn after a T. R. dose of 50 c.c. (+ 25 c.c. T. O.) was reached, and with the serum obtained from this blood the following experiments were made. I will remark, however, that the serum from later bleedings (after larger doses of the immunizing fluid had been administered) showed in all essentials the same characteristics, only in an intensified degree. For my experiments I used guinea pigs, monkeys, and to a certain extent rabbits. I preserved my serum by the addition of camphor, 0.5 per cent. phenol or 0.3 per cent. trikresol. The action of the serum on a healthy animal is only noticeable by a slight fall of temperature two or three hours after the injection (Table 1); this fall of temperature ranges from 0.5 to 1 degree. Comparative experiments (Table 2) with normal horse serum demonstrated, however, that here too the same phenomenon could be observed. The amount injected varied from 0.25 c.c. to 2 c.c. Otherwise, no local or general reaction occurred.

In order to determine the presence of any immunizing power of our serum, in one series of experiments (Table 3) five guinea pigs were treated during thirty days with repeated injections of .25 c.c. of the serum; they received altogether 4 c.c. of serum each. After thirty days three of them were inoculated with the fatal dose of tubercle bacilli, the two remaining ones being kept as controls. At the same time two fresh animals received the same fatal dose of bacilli. The result was that after twenty-four, respectively twenty-one days, the two non-treated animals died with the typical lesions of tuberculosis, while the three inoculated ones, as well as the two controls, remained healthy and continued to gain in weight, the same as they had done during the serum treatment. After six weeks one of the infected animals was killed; the autopsy did not reveal any lesions whatsoever, neither at the point of injection, nor elsewhere.

Two other sets of five animals each were subjected to similar conditions, only the amount of serum and number of injections varying. One series (Table 4) received during thirty days five injections of .25 c.c. of serum each. Of three animals of this series inoculated with the fatal dose of tubercle bacilli, one died after twenty days; the two others showed extensive infiltration around the point of injection, but no ulcerations. They did not lose in weight. Whilst this experiment shows that the quantity of serum was insufficient for complete immunization, its effect is nevertheless very apparent.

The third series was treated during the same length of time with five injections of .50 c.c. each. Then three of them were inoculated. All animals remained well and continued to gain in weight (Table 5).

Though these experiments comprised only seventeen animals, the evidence brought out by them may well be considered conclusive in view of the fact that even an intraperitoneal inoculation (Table 3, No. 21), which otherwise invariably results fatally in a short time, did not cause any lesions whatsoever.

Naturally, as the next step in my investigations, the question offered itself, how the serum would influence tuberculous infection, when applied at the very moment of infection. Various amounts of serum were therefore mixed with the fatal dose of bacillary emulsion, the mixture being injected subcutaneously or into the abdominal cavity. Of three guinea pigs which in this way received 1 c.c. each, not a single one showed any signs of infection; the same obtained for six others into which 0.5 c.c. each was injected and for the third set of three to which was given .25 c.c. each. When I lowered the dose to .10 c.c. the results became valueless (Table 6). As controls for this experiment two sets of three animals each served, one being inoculated simply and left without treatment, while the second set received with the bacilli .25 c.c. of Paquin's antitubercle serum. All six animals died within the usual time, two of the last (Paquin) set before the others.

We will see later on that our serum possesses very decided bactericidal properties. For this reason the experiments of the last series had to be varied so that bacilli and serum were injected at the same time, but each for itself, and in a different place. In this way three guinea pigs were treated, receiving the virus on the back, and the serum (.50 c.c.) on the abdominal aspect, as nearly as possible at the same time. They remained in perfect health, except No. 12, which showed, eight days after inoculation, a slight enlargement of the inguinal glands. The latter disappeared, however, in a short time, and the animal is as healthy today as are its mates (Table 7). After these tests the most difficult problem remained to be solved; how far advanced may a case of guinea pig tuberculosis be, in order to be amenable to a curative treatment by this serum? The number of my experiments bearing on this question is, I confess, but limited; I could convince myself that with almost absolute certainty one succeeds in saving the life of the animal when treatment is begun within the first ten days after inoculation with my culture. This time limit reached, the results became uncontrollable. I instituted treatment in several series four, seven and ten days after inoculation; injections (uniformly .25 c.c.) were given regularly every other day for four weeks; after that time one injection per week was deemed sufficient. Of eighteen animals I have lost, until the present date, not a single one, though in one an enormous glandular enlargement has developed. The characteristic ulcerations at the sites of inoculation are absent, and the temperature is normal.

Although I would not like to appear over-confident, the time elapsed since treatment was begun being only two and one-half months, I may safely assert that I consider those animals as recovered. In three of them I made the routine tuberculin test after six weeks of treatment without obtaining a reaction (Tables 8 to 11). Wherever ulcers had formed before the treatment they healed readily, no symptoms remaining to indicate a pathologic condition. The temperature was easily reduced to normal (Table 12); the weight kept steady or increased slightly.

Two animals of series 10 were sacrificed after seven weeks, to enable me to study the pathologic anatomy of the diseased organs. The liver showed those peculiar cicatricial ridges described by Koch as characteristic after T. R. treatment. The spleen in one case was extraordinarily contracted, etc. In one word everywhere successful attempts at restitution or at least at encapsulation were obvious, the latter especially in diseased lymph glands. A description *in extenso* of these very interesting changes I must reserve for some future time, after my animals have been observed for a longer period. As controls, I used again some animals simply inoculated with bacilli, and some others which in addition received the benefit of the Paqui

treatment. All of these animals died in due time.

For brevity's sake I omit to mention a number of other experiments destined to investigate the protective and curative potency of the T. R. serum. Those that have been reported are more than sufficient to establish the fact that this serum not only protects guinea pigs against infection, but that it is too, of a very powerful curative potency.

Very gratifying was also the outcome of some experiments made on monkeys (belonging to the genus *Cebus*, of the order of the *Platyrrhini*). On July 22, two of them were inoculated with .25 c.c. of bacillary emulsion into the abdominal cavity. While one served as control, the other was treated to regular injections every other day, of .50 c.c. of T. R. serum; this treatment was begun the day after inoculation. Very soon, in the control animal, high temperature set in (rising to 105 and 106 degrees), emaciation became visible, and on September 10 death occurred from the most extensive visceral tuberculosis I ever saw. The lungs were not affected at all. His more fortunate mate is today alive and healthy, and did at no time exhibit any symptoms of infection. His temperature remained perfectly normal, his weight increased slightly and some days ago he did not react at all after .15 c.c. of the old tuberculin was injected subcutaneously.

Very satisfactorily, too, resulted an experiment on two other monkeys, into the trachea of which, after tracheotomy had been performed, .25 c.c. of bacillary emulsion was injected. Treatment of one of them was begun immediately after inoculation (August 16) in the way described in the former experiments. The control animal died September 5 with very extensive lesions of the larynx, lungs, liver and the whole lymphatic system; an enormous tuberculous ulcer had developed at the place where tracheotomy was performed. Emaciation was very marked, as well as the anemia. In contradistinction, the other animal kept a steady temperature and weight, and offered no sign of disease, except a small ulceration of tuberculous nature at the place of incision; I feel sure that prolonged treatment will cure him entirely.

For certain reasons I would like to omit here a report of experiments with intraocular inoculation of rabbits. The well-known uncertainty of such experiments arising from very marked differences in the susceptibility of these animals is an element that prevents conclusive deductions. May it, however, be said that when inoculation and serum injection were practiced at the same time, in no case an infection was effected. The results varied whenever four or more days intervened between the two.

However tempting and alluring the reported results may appear to one uninitiated into the deceptive phenomena and phases of experimental tuberculosis, I will make haste in accentuating the fact, that *per se* they do not form conclusive evidence as long as the animals have not been observed for a longer period (five to eight months). In order not to be misunderstood, I must repeat that the period of my observations extends only over two and one-half months. But combined with the following considerations they form an absolutely safe stronghold. If the T. R. serum acted specifically, this must be due to antitoxic or bactericidal properties; it became necessary, therefore, to demonstrate the latter.

The slowness of growth as well as their peculiar cultural arrangement compelled me to submit the tubercle bacilli to the following procedures, which entirely differ from the usual method of determining the bactericidal power of a fluid. A number of sterile test-tubes were filled each with 5 c.c. of fresh T. R. serum. A few drops of an emulsion of tubercle bacilli were added to each of these tubes, whereupon the whole series was put into the incubator. After the lapse of a certain time the single tubes were removed and 1 c.c. of their contents injected intraperitoneally into healthy guinea pigs. Table 13 gives the results *in nuce*. It was found that a contact of the tubercle bacilli with the serum during five hours, was sufficient to destroy their vitality, or at least to impair their power of resistance so much, that the animal organism could easily rid itself of them.

The only attempt at determining this bactericidal power of an antitubercle serum, that I could find in the literature, was made by Babes,[19] but the bacilli in his case were killed only after a contact of twelve days duration. I do not know but what the addition of a preservative will decrease this power in my case to a certain degree.

In the search for antitoxic properties, the customary methods of combining the serum with a certain amount of old tuberculin (either fatal or just sufficient to bring about the characteristic tuberlin reaction) offered itself first. Babes and Schweinitz in this way proved the "antitoxic" nature of their sera. So did Niemann. But according to what has been said above, the only thing proven by these tests is their antituberculinic nature, which will be present, too, in a really antitoxic serum, but at the best only forms a part of its potency. That, by the way, not even this antituberculinic quality is possessed by some of the "antitubercle" sera, has been shown by Behring (l. c.), who found that Maragliano's serum is perfectly void of it. As to Paquin's antitubercle serum, I repeatedly came to the very same negative result.

How my T. R. serum behaves in this regard will be seen from table 14. I found that .50 c.c. of it is sufficient to save a tuberculous guinea pig from the fatal dose (.20 c.c.) of tuberculin, and that .1 c.c. prevents the tuberculin reaction (.10 tuberculin). The tuberculin that I used was of a strength that 1.5 c.c. killed a 500 gram healthy guinea pig within twenty-four to forty-eight hours; I prepared it from cultures of my virulent bacilli. Niemann for his serum, found the relation 7 to 1, while in our case it would be 1 to 1.

But since it was evident that tuberculin did not mean tuberculosis toxin, I worked out another method, which with due regard to the incompleteness of our knowledge gave very satisfactory results.

I profited by Koch's investigations, combining T. O. with T. R. and so getting a fluid which contained, in an absolutely unchanged form, all of the substances (toxins, etc.), the effect of which on the animal organism was to be studied. After the whole of the bacilli had been thoroughly triturated, I gauged the suspensions of them so that every c.c. of the 20 per cent. glycerin solution contained 1 mg. of solid substance. Doses up to 8 and 10 c.c. of this fluid were borne by healthy guinea pigs without any trouble; higher doses produced irregular fever, and infiltration; 15 to 16 c.c. invariably caused death.

Quite different was the action on tuberculous animals; 1 mg. always produced, within thirty-six hours, an extended inflammatory infiltration, and a stormy fever reaction differing from the tuberculin reaction

inasmuch as the rise of temperature appears rather sudden (two or three hours after injection) and keeps steady for ten to twelve hours, after which time a decline by lysis occurs. The infiltrations disappear within three days, usually. Very characteristic and interesting is the fact, that in one and the same animal such a reaction may be elicited indefinitely, by only a slight increase of the dosage (Table 15). The common tuberculin reaction, in the same animal, usually fails the third or fourth time. I do not know yet what influence our reaction has upon the tuberculous lesions; existing ulcers heal readily.

If instead of 1 mg. we use 2 mg., this dose invariably produces death within twenty-four hours.

Before we can utilize this toxin for determinations of the antitoxic value of our serum, one objectionable feature of the test will have to be removed, the inequality of the extent of the tuberculous lesions in the animals used. Although in guinea pigs the disease partakes of the character of a self-limited trouble, the extent of the lesions and the constitutional conditions vary enormously in different animals inoculated at the same time. The reactive capacity, naturally, varies with these conditions so that, although for qualitative tests any animal, provided it be tuberculous, will be satisfactory; this is not so for quantitative determinations. Here we must be, as far as possible, sure to always encounter the same power of, or rather lack of power of, resistance in our animals.

The beautiful investigations of Borrel[20] and Kaspareck[21] furnished the material to obviate this difficulty; while the former demonstrated the fact that as soon as thirty-six to forty-eight hours after inoculation, tissue changes became observable, the latter added the valuable information that for the appearance of the tuberculin reaction such tissue changes are necessary, and that this reaction may be typically observed about thirty-eight hours after infection. The eminent theoretic importance of these two facts is apparent (perhaps especially with regard to an alleged pre-tuberculous stage of the disease). I found in them a means to procure for my tests a nearly always equivalent material. If into healthy adult guinea pigs of about the same weight (500 to 700 grams), always the same amount of virus (one loopful of my culture) is injected, and if at a stated interval afterward (forty-eight hours) the same amount of T. O. and T. R. toxin, together with the serum to be tested, is administered, we have done as much as can be done in order to obtain comparable results.

Preliminary experiments showed me that 1 c.c. of my toxin injected into these forty-eight hour guinea pigs elicited the above described reaction, together with a very marked infiltration, while 2 c.c. were here, too, found to be the fatal doses.

By such experiments I knew also that less than 1 c.c. of my serum inhibited all these reactions. If, therefore, we agree to call an antitoxic unit 1 c.c. of that serum which counteracts 1 mg. (1 c.c.) of toxin (always supposed that the serum has been prepared by means of the same race of bacilli from which the toxin is derived), it was easy to determine the potency of the serum under discussion. Accordingly a number of guinea pigs, of about 500 grams weight, were prepared in the way described, whereupon various amounts of serum, each mixed with 1 c.c. of the toxin were injected after forty-eight hours. While .3 c.c. were not able to materially influence the reaction, with .4 c.c. no temperature reaction, nor local infiltration occurred; .6, .8, and 1 c.c. acted in the same way. This means that the serum is 2.5 times more active than a normal antitoxic serum. In other words, that it represented 2.5 antitoxic units to the c.c. This seems to be a very low value, when compared with the potency of other antitoxic sera. But the serum of the same horse one month later, after immunization had been continued all the time, showed a potency of 3.7. The serum of another horse was found of a strength of 2.8 the first time, of 4.1 six weeks later. These findings I believe to be the most valuable part of my work, since they justify the hope that in due time a serum of very high power may be obtained.

On the other side we must not forget that our serum is not only antitoxic, but in a very high degree also bactericidal, the latter quality being, under certain circumstances, probably more valuable than the former. Furthermore, I think it highly probable that later on a tubercle virus may be obtained of much greater toxicity. Some experiments are under way to find out whether after a method similar to that of Metchnikoff, Roux, and Salimbeni[22] (cultivation of tubercle bacilli enclosed in small pouches of collodion which are introduced intraperitoneally into guinea pigs or rabbits), still more virulent forms may be obtained. Be that as it may, my researches so far have demonstrated *the fact that a serum both antitoxic and bactericidal may be obtained by immunizing horses against tuberculosis by the new tuberculin T.R., and that it is possible to immunize (and cure) guinea pigs with perfect certainty by means of the serum for which I propose the name "Antiphthisic Serum, T.R."*

It would be unnatural not to consider the possibilities that my serum may hold out for the treatment of human tuberculosis, although it is with great reluctance that I venture to make a few remarks on this point. After what has been said in the beginning of this paper, I take the applicability of antitoxin treatment in human tuberculosis for granted. Moreover, the chronic form in which the process usually is met with in man, has certainly to be considered as a favorable point. It can be shown experimentally that the relative toxicity of the watery extracts of finely ground tissues of the organs of tuberculous guinea pigs is enormously higher than that of human tuberculous tissues, in other words, this very chronicity is indicative of a process less productive of toxins. As an admissible objection it might be said that one is not allowed to infer from phenomena observed in one animal, or those observed in another. The more penetrating our investigations become, the more we are forced to admit that the virulence and toxicity of a micro-organism, is by no means the same upon different animals. I think, however, that in the case of the tubercle bacillus, though for obvious reasons a direct proof can not be had, we are perfectly safe in surmising that these differences, if existing at all, are only differences of degree and very slight ones too. In the multifariously confirmed tranmissions from animal to man, and *vice versa*, I am inclined to see a confirmation of this surmise.

The antitoxic potency of my serum seems as yet, when compared with other antitoxic sera, to be small, but I do not know whether we have a right to doubt *a priori* its efficacy in man on that account; in the first place, we do not as yet know anything with certainty about the way in which this antitoxic property exerts itself, and whether we are allowed to estimate it quantitatively.[23]

But besides this it is a fact that the main toxic action is not exerted by the living bacilli, but by the dead and disintegrating ones, so that a smaller amount of antitoxic power supplied continually will be likely to meet all exigencies. These, however, are problems to be solved in the future. I will only repeat that there seem to be theoretically no limits to the degree of the antitoxic potency, and that practically it is a matter of time and, since T.R. is a rather expensive article, of financial considerations.

The value of T.R. serum for human patients can only be ascertained by a prolonged observation. In about twenty cases so far treated by me and several physicians in and outside of St. Louis, the results have been exceedingly gratifying. I need not tax your patience by telling you what kind of cases we may reasonably expect to be benefited by such treatment. I must lead your attention, however, to the statements of Spengler,[24] asserting that a great number of so-called mixed infections are not *a priori* to be considered as hopeless, but that secondary infection very often rapidly subsides and disappears, as soon as some curative influence comes to bear on the tuberculous process.

All of the cases treated, so far as the reports show, were early cases of pulmonary affection; a positive diagnosis was made in every one of them by microscopic examination. In all of these cases, within six to eight weeks a very decided improvement was brought about; temperature became perfectly normal; cough, expectoration, and night sweats stopped; uniformly a considerable increase in weight was observed. The pulse became normal, number of respirations decreased, etc. In all cases, physical examination showed an arrest of the active process, and a clearing up of the affected area; in those cases observed by me the moist râles disappeared within four weeks after treatment began. The latter consisted in daily hypodermic injections of 1 c.c. of the serum. No local or general reaction resulted except now and then a little soreness and swelling around the site of the injection. The most noticeable fact was the lowering of the afternoon temperature, which sometimes would be observed after the first few injections.

I would, however, not like to lay myself open to the reproach of hasty conclusions in a subject the chief element of which is time. A more extensive report will be rendered after the necessary time has elapsed.

The scientific gain of my investigation is the preparation of a really antitoxic and bactericidal antiphthisic serum. With a probability next to a certainty we may expect this serum to become an important factor in the preventive and curative treatment of human tuberculosis; the "importance" of the declining attitude of the Moscow Congress toward serum treatment in tuberculosis will, I am sure, dwindle down to the insignificance and worthlessness inherent to all judgments and criticisms of gregarious masses.

1635 S. Grand Avenue.

BIBLIOGRAPHY.

JOURNAL AMERICAN MEDICAL ASSOCIATION, Aug. 21, 1897, p. 359.
2 W. Freudenthal in an article on the "Etiology of Pulmonary Tuberculosis," Annals of Otology, February, 1897, makes some very appropriate remarks on this point.
3 Strauss and Gamaleia, Arch. de médec. expér., 1891. Mafucci: Centralbl. f. allgem. Pathol., 1890.
4 New York Med. Jour., July 24, 1897, and JOUR. AMER. MED. ASSOC., July 17, 1897.
5 Zeitschrift für Hygiene u. Infectionskrankheiten, XXIII, Heft III, p. 367.
6 Bacteriolog. Centralbl., 1897; Münchener medicin. Wochenschrift, 1897.
7 l. c.
8 S. Pansini, Alcune osservazioni sulla tuberculosi, especialmente sulla tossicita del suo bacillo. Giorn. internaz. d. scienze mediche. Anno XVII.
9 See A. Maksutow in bacteriol. Centralbl. XXI, p. 317.
10 Bacteriol. Centralbl., XVIII, p. 126.
11 l. c., p. 362, etc.
12 Bacteriol. Centralbl., XXI, p. 74.
13 Deutsche medicin. Wochenschrift, April 1, 1897.
14 Berliner Klin. Wochenschr., No. 28, July 12, 1897, and Deutsche medicin. Wochenschr., June 17, 1897.
15 For instance, Trudeau and Baldwin, Medical News, Aug. 28, 1897.
16 Cfr., however, Pansini in Bacteriol. Centralbl., XXII, p. 188.
17 Buchner seems to have obtained the same or a very similar result by a different method.
18 Tuberculin and mallein test negative.
19 l. c., p. 365.
20 "Tuberculose pulmonaire expérimentale," Paris, 1896.
21 Wiener Klinische Wochenschrift, 1897, No. 26.
22 "Toxine and Antitoxine Cholériques." Annals de l'Instit. Pasteur, X, 1896.
23 Berlin Klin. Wochenschrift, June 21, 1897, p. 551.
24 Zeitschr. f. Hgy. u. Inf. Krankh., XVIII, 1894.

METRITIS.

BY BYRON ROBINSON, B.S., M.D.

Professor in the Chicago Post-graduate School of Gynecology and Abdominal Surgery; Professor of Gynecology in the Harvey Medical College and the Illinois Medical College; Gynecologist to the Woman's Hospital; Gynecologist to the Woman's Charity Hospital, and Consulting Surgeon to the Mary Thompson Hospital for Women and Children.

CHICAGO.

For many years I have been observing in the practice of gynecology a peculiar disease of the uterus characterized by hypertrophy, atrophy or induration. In the chronic state the uterus is hard in consistence. Its walls are rigid and stiff. The disease may occur in a girl of 15 years, or in woman before or after the menopause. It is known as metritis, *i. e.*, an inflammation of the uterine muscularis. I shall attempt to bring forward some views on the disease by the aid of carefully drawn microscopic illustrations. In the

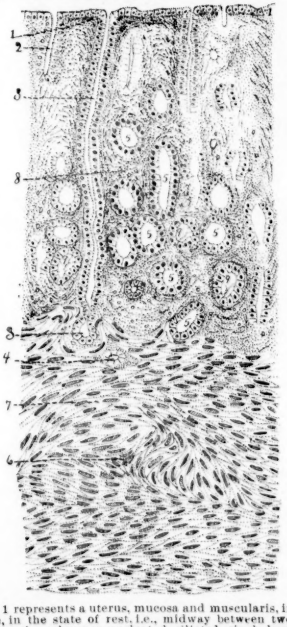


Figure 1 represents a uterus, mucosa and muscularis, in the quiescent stage, in the state of rest, i.e., midway between two menstrual periods. 1, 1, the columnar nucleated, ciliated, single-layered uterine epithelium; 2, a part of a utricular gland opening on the inner surface of the mucosa; 3, a whole utricular gland cut longitudinally, extend-

ing from below the level of the muscularis to the internal surface of the mucosa. It is lined by a single layer of distinctly nucleated cylindric columnar (and ciliated?) epithelium. Observe how it ends in the muscularis and how the muscular trauma or contractions could induce the migration of contained pathogenic microbes into the field of the muscularis, producing inflammation and its results; 4, represents the tip end of a utricular gland far beneath the surface of the muscularis; 5, 5, 5, 5, 5, 5, show empty, resting utricular glands cut at varying angles to the longitudinal axis; 8, points to the lymphoid tissue composing the mucosa, i.e., the connective tissue cells and fibers, the blood and lymph vessels; 9, 9, shows resting glands containing a little mucus; 6, shows a blood vessel in the muscularis, and 7 points to the nucleus of the unstriped muscular cells. The two characteristic structures observed are: *a*, the mucosa containing utricular glands, connective tissue cells and fibers, blood and lymph vessels; *b*, the muscularis containing unstriped muscular fibers and blood vessels; and *c*, the peculiar anatomic fact that the glands of the mucosa dip down into the muscularis. There is no submucosa in the uterus. The muscularis is not protected from the mucosa by a submucosa, and hence the easily infected utricular glands quickly carry infection into the unprotected muscularis. Other hollow viscera like most of the digestive tract are protected from infectious invasion by a layer of tissue, the submucosa, which separates the glandular, the mucosa, from the muscularis. Besides, the submucosa, e.g., in the stomach, allows a wide, independent movement of the mucosa and muscularis. In the uterus the mucosa and muscularis are immovably fixed on each other. Observe the solid, compact glands and tissue in the uterine mucosa and the small nucleus of the muscularis in the resting uterus.

illustrations I have attempted to show typical specimens of a quiescent uterus or one at rest, one specimen of a uterus in the first day of menstruation, and a specimen of about ten weeks' pregnancy, and two more sections cut at right angles to the utricular glands. The specimens should be studied comparatively to observe the vast yet gradual difference occurring in the uterine mucosa.

Metritis is one of the most frequent diseases of women. About ten women out of fifteen who come to the clinics have a distinctly palpable metritis, over the diagnosis of which no dispute may arise. Metritis occurs in all grades, from the sensitive, acute to the stage where little sensation remains.

Figure 2 represents a uterine mucosa in the first day of menstruation, which I obtained by vaginal hysterectomy from a thirty-five year old multipara. Observe the two great structures; the mucosa and the muscularis are changed like magic. The mucosa is almost doubled in thickness, the glands are elongated, sinuously dilated, with folded walls, and many contain blood and mucus. Several utricular glands (5, 5, 5) descend further down into the muscularis than in the resting uterus. Note the increased size of the nucleated, columnar epithelium in the menstrual uterus over the resting uterus. The interglandular substance, the lymphoid elements, connective tissue cells and fibers, the blood and lymph vessels, are all vastly increased over the resting uterus. In the menstruating uterus the muscularis, the nuclei of the muscular cells, are about doubled in length and breadth. With good specimens one can observe the large amount of fluid lying in the tissue and forcing the elements wide asunder. Also the ubiquitous leucocyte aids to increase the thickness of the muscularis, and especially the mucosa, in the menstruating uterus. Especial attention is directed here to the fact that the columnar, nucleated endothelium lining the mucosa and utricular glands, is nowhere (first day of menstruation) shed, but intact everywhere, and nearly double the size of that in the resting uterus. 1, 1, represent almost complete utricular glands cut longitudinally; 3, points to the bloody debris found in this sinuously dilated menstruating gland which opens on the internal surface of the uterine mucosa and dips deep down into the muscularis; 2, points to a widely open utricular gland with enormously developed epithelia; 4, points to the vastly increased interglandular substance, lymphoid elements, connective elements, blood and lymph vessels, all forced asunder by edema, infiltrated fluid; 5, 5, 5, 5, point to utricular glands buried beneath the muscularis, and 5[1] can be traced from the internal surface of the uterine mucosa to a long distance below the surface of the muscularis. The bloody debris in the utricular gland found deep in the uterine muscularis demonstrates that it is actively engaged in the act of menstruation; 6, points to the vastly increased size of the nucleus of the muscle during menstruation. The mucosa and muscularis alike engage in the great change accompanying menstruation, i.e., violent glandular and vascular changes.

As an explanation of the tendency of the uterus to inflammation over other organs we must look to its peculiar structure. It may be stated without fear of successful contradiction that the uterus is not only prone to inflammation, but it is prone to harbor it for an indefinite period. The carefully prepared cuts accompanying this article, drawn from my own specimens, will explain the mechanism a thousand times better than words. The uterine wall consists of three tunics, viz.: tunica mucosa, tunica muscularis and tunica serosa.

First, the uterine mucosa, the endometrium, the tunica mucosa or propria, or the lining membrane of the uterus furnishes the clue. It is composed of tubular glands standing nearly at right angles to the uterine wall. These glands (glandulæ uterinæ, utricular glands) are lined by a distinctly nucleated columnar ciliated epithelium. The ground work sustaining the glands consists of a peculiar connective tissue cell and a connective tissue fiber. The mucosa is rich in this lymphoid embryonic-like tissue. It is also rich in blood vessels and abundant lymph elements. The uterine mucosa undergoes variable changes during the subject's seed-time and harvest. At the menstrual time it is often doubled in thickness, becoming about one-fifth of an inch thick. During gestation, the mucosa undergoes considerable changes, but apparently not so violent and rapid as at the monthly period. The three chief changes of the mucosa at menstruation and gestation are: 1, Elongation and sinuous dilatation of the glands; 2, Enormous distension of the blood and lymph vessels; 3, Increase of interglandular substance by multiplication of the embryonic type of connective tissue cells and fibers, the migration of red and white blood corpuscles and the infiltration of the mucosa with fluid.

The significant vascularity (blood and lymph vessels) and the predominent glandularity (lymph elements) characterize the uterine mucosa and mark it as a field rich in susceptibility to infectious invasions, and since the uterine mucosa is not only directly exposed to the external world, and especially to sexual imprudence and consequent infection, but also to the violent congestions of menstruation and the rapid changes of gestation, it is no wonder that its delicate structure and wonderful function becomes impaired.

Now, the significant peculiarity of the uterine mucosa is, that it rests directly on, and some of its glands penetrate, the uterine muscular wall. There is no submucosa in the uterus. There is no barrier to infectious invasion from the uterine mucosa to the uterine muscularis. Infection can travel directly, by way of

the utricular glands, into the muscularis. No military trocha exists between the mucosa and muscularis in the uterus to prevent general infectious invasion. No finely woven connective tissue, submucosa, forming a distinct barrier, a partially impenetrable layer to infection, is found in the uterus.

The wonderful mobility of mucosa on the muscularis, which so typically exists in the gastro-intestinal tract, does not occur in the uterus. The uterine mucosa and muscularis do not move independently of each other. They are intimately bound and connected together. In this intimate and close connection of mucosa and muscularis, perhaps is also found an explanation of further infectious invasions from muscular trauma on the utricular glands. We may call a menstruation a diminutive labor. In menstruation and gestation, the uterus is in a constant rhythm or fine small waves of contraction. Now, we observed that some of the utricular glands dipped their proximal ends a considerable distance down into the uterine muscularis. In the menstrual period the muscular waves or contractions are vigorous and active; the muscular contractions are continually traumatizing, continually disturbing the ends of the utricular glands which lie among the contracting muscles, and hence will induce the migration of pathogenic microbes through the glandular wall into the connective tissue of the uterine muscularis, with consequent inflammatory process. Muscular trauma on contained glands holding pathogenic microbes aids to spread infection. The congestions of the uterus induce muscular contractions and this process, being often repeated, allows frequent opportunities for progressive infection.

Muscular trauma must be an admitted factor in the production of disease; it disseminates germs, especially from glands to adjacent tissue, it disturbs the blood vascular and lymph vascular system and the frequent muscular activity of the uterine muscularis on the uterine glands, which are not protected by a submucosa, traumatizes them and aids to disseminate their pathogenic contents.

The first consideration in metritis is to study how metritis arises. Why does a woman have metritis, with hypertrophy or atrophy, at any time from puberty to far beyond the menopause? When a girl has her first menstruation the os dilates, the mucosa swells and becomes intensely vascular and the utricular glands dilate irregularly with sinuous and folded walls; also the muscularis is in continual waves of contraction. Intense vascularity, edema, migration of leucocytes, dilated lymphatics and highly swollen glands characterize the uterus at menstruation. In this susceptible state, a rich culture medium for germs, the uterine mucosa may become infected by microbes entering the open os from the clothing, from masturbation, from cohabitation, from the dust of the road, from the rectum, and also, it may become exacerbated from repeated menstrual processes. The resistance of her mucosa may be lowered by attacks of scarlet fever, measles, smallpox; in fact, by any acute fever. However, one of the above processes is doubtless the method by which young girls' uteri acquire metritis. Erectile tissue with congestion and decongestion alone will not explain uterine disease, because the penis passes innumerably more times through congestion and decongestion than the uterus, but does not become diseased. The element of infection must be the factor that plays the rôle in the glandular structure found in the muscularis-mucosa.

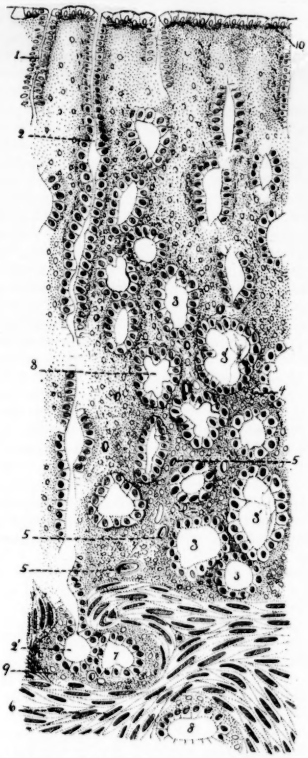


Figure 3 represents the uterine mucosa and muscularis pregnant about ten weeks. This specimen differs from the resting uterus by hypertrophy, and from the menstruating uterus by uniform hypertrophy. In the pregnant uterus the utricular glands and blood vessels, as well as the interglandular tissue, are increased uniformly. In the menstruating uterus the utricular glands and blood vessels are not uniformly increased, but show sudden dilatation and consequent sinuous and folded walls. The glandular epithelium and the walls of the blood vessels in the menstruating uterus are much less in size than in the pregnant one. The interglandular tissue of the mucosa of the menstruating uterus is more edematous, more infiltrated with fluid than the pregnant uterus, and consequently the elements are forced wider asunder by the fluids than in the pregnant uterus. The utricular glands of the pregnant uterus do not contain blood and debris like that of the menstruating uterus. In pregnancy only mucus is found in some of the utricular glands of the uterus. The resting uterus (Figure 1) shows compact interglandular tissue and lymphoid elements. The menstruating uterus (Figure 2) shows interglandular structure, swollen, edematous lymphoid and connective elements widely separated by considerable fluids, many leucocytes, and especially sinuously dilated utricular glands with sinuous and folded walls, the glands containing bloody debris. The nucleus of the muscles are almost doubled in size. The pregnant uterus differs by a peculiar kind of hypertrophy. Its glands are uniform and smooth, and like the resting uterus, but enormously increased; they contain mucus like those of the resting uterus. The epithelia lining the internal surface of the mucosa and utricular glands are hypertrophied with enlarged nucleus. The nucleus of the muscle cells of the pregnant uterus is three to four times the size of the resting uterus and perhaps over twice as large as those of the menstruating uterus. The utricular glands of the menstruating uterus show well their penetration of the muscularis, but the utricular glands of the pregnant uterus demonstrate vastly more than deep penetration and residence of the hypertrophied muscularis. 10, represents the vastly hypertrophied epithelia of the internal surface of the mucosa; 1 and 2, point to the epithelia of the hypertrophied utricular glands; 3, 3, 3, show empty hypertrophied utricular glands, while 3' and 3'' show the same with small amount of mucus; 4, indicates hypertrophied interglandular, lymphoid connective tissue and vascular elements; 5 and 5, blood vessels; 6, hypertrophied nuclei of the muscularis; 7, 8 and 2', show utricular glands, hypertrophied, well buried, deep in the recesses of the muscularis. Figures 1, 2 and 3 are carefully drawn from well-prepared specimens.

It may be stated that the chief forms of metritis

are developed from abortion and labor. In metritis the first stage is intense congestion, venous, arterial and lymphatic. The uterus swells, considerable edema and small cell infiltration occurs in the mucosa-muscularis. The serosa does not appear to suffer so much when attacked ectoperitoneally. Chronic metritis is characterized by hypertrophic thickening of connective tissue. The muscularis may be partially or completely in a state of degeneration, fatty, pressure atrophy. Some of the muscular fibers may be entirely crushed out, while others may lie in irregular bundles. Much significance rests in the blood vessels in metritis. The vessel becomes irregular, by irregular contraction of the connective tissue bundles their lumen partially obstructed. Dilatation and constriction by connective tissue characterize the uterine vessels in metritis. The vessels may become varicose. The painful menstruation in metritis rests on the fact that the uterine vessels are surrounded by dense white connective tissue, and when the congestion and consequent expansion of these vessels occur at the menstrual period, intense pain arises from pressure on the peripheral nerves in the vessel walls and closely adjacent tissues. A well prepared section of chronic metritis looks pale and shiny, with hard, white connective tissue bundles lying irregularly in the field, interspersed with reddish masses of the muscular bundles. The enlargement of the metritic uterus may be due to the cicatrization of the muscular bundles or hyperplastic growths in the lymph spaces; perhaps both processes occur together.

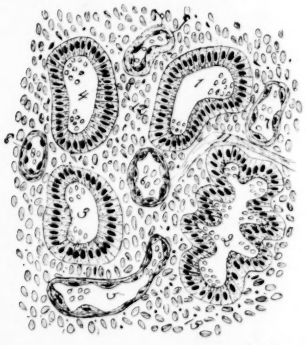


Figure 4 represents the mucous membrane of a thirty-five year old multipara in the first day of menstruation. The section of the mucosa is made perpendicular to the long axis of the utricular glands. 1, 2, 3 and 4 are utricular glands; 5, 6, 7, 8 and 9 represent blood vessels; 11 represents a fasciculus of connective tissue; 12 and 13 represent the ground substance of the uterine mucosa, i.e., connective tissue fibers and connective tissue cells. In this subject the mucosa was about one-fifth of an inch thick, i.e., about twice as thick as it is in the normal resting state. First the glands are irregular, elongated and widely dilated with fluid, and the walls are especially folded and sinuous as in Figure 2. Considerable blood is plainly seen in the glandular lumen. The sudden filling of the utricular glands at menstruation does not give them time to distend uniformly; but they expand in the direction of least resistance, as is observed in every gland, but especially in No. 2. The whole mucosa and immediately adjacent muscularis is very edematous. The elements are widely distended by fluids. The lymphatic spaces are very apparent around the glands in the muscularis; leucocytes are numerous. The blood vessels (6, 7 and 8) are widened and filled to distension with blood. The epithelium of the glands is not shed. It is perfectly intact. The muscularis is especially thickened by the distention from fluids. No. 5 doubtless represents a venous sinus cut longitudinally. This section was made near the internal surface of the mucosa, hence no unstriped muscular bundles could be observed dispersed between the glands. The sinuous or folded condition of the walls of the utricular glands is quite a characteristic during the active stage of menstruation. In pregnancy of two to three months the glands are more hypertrophied than in menstruation; also the utricular glands possess a uniform hypertrophy in pregnancy, and do not show a sinuous or folded character of their walls, as is shown in the congested stage of menstruation.

The large metritic, hypertrophic uterus consists, to a great extent, of excessive growth of connective tissue in perivascular lymph spaces. Intense congestion and vascular stasis leads to overnourishment, resulting in hypertrophy. Atrophy is but a decadence of hypertrophy. The muscles are crushed out and the vascular supply gradually diminished. The contraction of the shiny, hard, glistening, irregular connective tissue bundles of the uterine muscularis leads to obstructing arterial flow and impeding venous and lymphatic (return) flow, some of the vessels assuming at first a varicose condition, and finally there exists an indurated uterus with but small and weak blood supply. The scene of the metritic uterus is almost constantly connected with endometritis. In the chronic glandular endometritis the glands may enlarge, increase in number, become occluded and dilated and project deeply into the uterine muscularis and absolutely simulate malignancy by alveolar appearances of the glands. In this manner the glandular endometrium perpetuates metritis indefinitely.

The course and prognosis of metritis is absolutely indefinite. I have treated scores of cases for at least five years. I carefully treated one case ten years for a large metritic uterus, and finally assisted Dr. Lucy Waite in performing an abdominal hysterectomy, whence the patient, from over ten years of invalidism, became well and fat in a few months. The prognosis of the metritic uterus following gonorrheal endometritis is often hopeless, because the gonorrheal infection is so persistent and continuous, inviting mixed infection, that both the mucosa and muscularis are structurally crippled beyond repair. However, many metritic uteri can be repaired so that the patient is partially well, and some perfectly well (symptomatically).

The diagnosis of metritis is easy to make (omitting the acute). With the index finger in the vagina and the other hand on the abdomen, the uterus feels hard, rigid, stiff and solid. A normal uterus should feel like a living muscle in partial tension, in slight activity. It should bend, yield and glide unimpeded in all directions. In short, it should be perfectly mobile, like a normal testicle. The metricic uterus exists in many degrees. It may feel like a muscle in vigorous high tension or as hard as cartilage or a turnip. It will not bend nor glide about normally; it is dislocated because it is permanently fixed. It is fixed by its own rigid, hard walls. The metritic uterus is always in fixed version or flexion, because (pathologic) version or flexion means fixation, it means dislocation. In this relation, four propositions may be well remembered, viz.: 1. Anteversion is where the uterus lies extended forward and is abnormally fixed. 2. Anteflexion is where the uterus is curved on its anterior surface and is abnormally fixed. 3. Retroversion is where the uterus lies extended backward and is abnormally fixed. 4. Retroflexion is where the uterus is curved on its posterior surface and is abnormally fixed.

The symptoms of metritis occupy wide fields according to its intensity and the individual susceptibility. In women the ganglionic system is developed to a greater extent than it is in men. The ganglia are not only large and more numerous, but they are richer in nerve distribution. This makes women more enduring and tenacious of life, but also it makes her more subject to reflex neurosis. The irritation arising in the uterus, an organ dominated by a rich supply from the

sympathetic, like electricity streams to all other viscera. The genitals are like an electric bell button, which being pressed rings up the whole system.

Now, the learned neurologist will gravely announce that reflexes do not create deep-seated disease, and the reverse, that deep-seated disease will not be cured by removing the reflexes or its cause, to which we lend an attentive ear. However, we will claim that irritation in the (genitals) uterus, creates by reflex action disturbance in function in distant viscera. The disturbance in function soon begins a train of suffering, an impairment of health. We must say first that metritis produces symptoms of reflex irritation in various viscera, especially the stomach (digestive apparatus), and second, symptoms of pain. The manifest pain of metritis is in the pelvis, back and head. The systematic train of evils following metritis are: 1, irritation; 2, indigestion; 3, non-assimilation; 4, Anemia, and 5, neurosis. In many cases this evil train is very slow in arising.

Again, it must not be forgotten that many women have metritis with insufficient symptoms to make them conscious of its presence. I have examined many such women.

The treatment of metritis is medical and surgical.

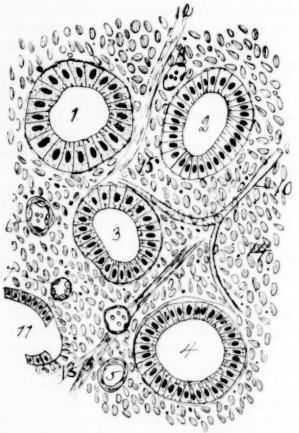


Figure 5 represents a section of the uterine mucosa of a ten weeks' pregnancy. The section is made at right angles to the long axis of the utricular glands. 1, 2, 3, 4 and 11 represent glandulæ uterinæ. Observe the glands are large, but uniformly hypertrophied and distended. The epithelia of the glands appear to be elongated. No. 11 represents a partial utricular gland with part of its epithelia fallen out; 5, 6, 7, 8 and 10 represent blood vessels which are enlarged, but especially show thickened walls; 12 and 13 represent a fasciculus of connective tissue traversing the uterine mucosa between its glands. The ground substance, 14 and 15, show connective tissue cells and fibers, all enlarged, but it does not show the edema of menstruation. The special characteristics of pregnancy are in the uterus, uniform thickening of the vessel walls, uniform enlargement of the glands, elongation and apparently multiplication in the form of diverticular building. The muscular cells are thickened and elongated and increased in number, and the connective tissue of the mucosa is increased in its cells and fibers; in short, the glandular (lymphatic) vascular connective tissue and muscular elements seem to be not only hypertrophied, but increased in number.

First, so many women are afflicted with metritis that surgical application could not and should not be applied to but a comparatively few. The medical side of metritis is the chief one and in the majority of cases we can do much. The object is to restore the uterus to normal or to repair the damaged organ as much as possible, to relieve the patient from the accompanying reflex action and disturbing symptoms. Fortunately, for physicians, most diseases tend to get better. We can do but little for the atrophic, indurated uterus, except to relieve pain, and fortunately the atrophic indurated uterus is not afflicted with much pain. It is in the hypertrophied metritic uterus where we can do the most practical good. To treat it we attempt to limit its blood supply, in other words, to starve out the excess of tissue. This is accomplished by hot fluids, astringents and hygroscopic materials. I give the following directions for a vaginal douche:

1. Use a fountain syringe, holding four gallons of water, with a four-foot head.

2. Begin with three quarts of boiled water at 103 degrees (married women).

3. Increase the heat 1 degree at each sitting until it is as hot as it can be borne.

4. Increase the amount of the douche one pint each time until four gallons are taken.

5. Use the douche in the morning, and in the evening when retiring.

6. The duration of a vaginal douche should be eight minutes to the gallon.

7. The patient should lie on the back with the thigh flexed on the abdomen and the legs flexed on the thighs.

8. The douche should be taken on a level plane, the ironing-board serving a good purpose, and not in the bed, or on the water-closet, or in the bath-tub.

9. The douche should never be taken in the standing or sitting posture.

10. A handful of salt (NaCl) and a teaspoonful of alum may be added to every gallon; the salt to prevent reaction and the alum to astringe and check waste by secretion.

11. The vaginal tube used in giving the douche should be sterilized and every patient should have her own tube.

12. A vaginal douche given according to the above directions will prove to be of much therapeutic value in the treatment of pelvic diseases, an agent to prevent disease and a great comfort to the patient.

The effect of a vaginal douche is: 1, to contract tissue, *i.e.*, muscle, connective, elastic; 2, to contract vessels, *i.e.*, arteries, veins, lymph; 3, to absorb exudates; 4, to relieve pain; 5, to check secretion; 6, to stimulate (tonic); 7, to cleanse parts.

A second form of medical treatment for metritis consists in the use of cotton (or wool) tampons soaked well in boroglycerid (glycerin, 16 ounces; boracic acid, 2 ounces). The tampon is distinctly hygroscopic and an excellent mechanical support; otherwise it has a similar effect with the vaginal douche. The tampon may be used three times a week and allowed to remain in the vagina for ten hours. With six months or more of such treatment the hypertrophic uterus is nearly always benefited and frequently so much improved that the patient is comfortable. Sometimes she is cured symptomatically or perfectly. Pregnancy often cures it perfectly. Painting the cervix with various materials is, so far as my observation goes, of very limited benefit.

The surgical treatment of metritis consists in dilatation, curettement and the application of a caustic, Alexander Adams' operation or hysterectomy. A fixed uterus should always be curetted with caution. Dilatation of a metritic uterus is accompaned with dangerous trauma. Some metritic walls are so thick that they can not be dilated and often vastly more damage

than good is done to a metritic uterus by dilatation. The solid, metritic walls will not dilate without thousands of localities of trauma, which prepare the way for wider and more intense infection. Some may be curetted with a small curette without dilatation and endometrium cauterized, pure carbolic acid being one of the best caustics. However, from experiment with the curette on recently removed uteri, I am convinced the curette is not what accomplishes the good effect, but it is the applied caustic, the pure carbolic acid which sloughs off the old chronically inflamed endometritis and allows a new endometrium to appear, giving nature a chance to rejuvenate itself. I use a rubber tube stitched in the uterus to drain for a week, washing it out with alcohol and sterilized water from the third day on. Some use gauze, but gauze is a poor drain. It may be borne in mind that it is dangerous to curette a fixed metritic uterus and it is even more dangerous, from trauma, to dilate a thick-walled metritic uterus. Hence, the douche and tampon are often more successful than the dilator and curette in a large metritic uterus. The Alexander Adams' operation is often of value in the hypertrophic metritic uterus. Its upright position will allow vascular depletion. The hard ring and intrauterine stem pessary are a traumatic evil and are mentioned only to be, in general, condemned.

To say that metritis calls for hysterectomy to cure a patient, would doubtless call anathemas on my head from many physicians whom I respect. But I have cured absolutely, from metritis, so many patients by hysterectomy who were invalids for years previous, that I dare to follow the operation and abide by the result to tell its own simple story. Of course, only selected cases of metritis call for hysterectomy, after which patients get well and fat. I now nearly always remove the uterus when both appendages require removal. Dr. Lucy Waite and myself have now practiced the removal of the uterus with bilateral disease of the appendages for over three years and our satisfaction grows with improving results. The hard, solid, hypertrophic, metritic uterus can be sometimes cured only by extirpation; the safest route is per vaginam.

There is a significant question as to how far the frequent metritis enters into the etiology of uterine myomata. Doubtless many myomata are due to local disturbances in uterine circulation.

THE ETIOLOGY OF METRITIS INFECTION.

Kinds of infection: Gonococcus; streptococcus; staphylococcus.

Modes of entrance: Glandular; circulatory lesions; tissue.

Predisposing causes: Labor; abortion; lack of submucosa; menstruation; sexual irritation; the mucosa and muscularis do not move independently; traumatic lesion; vascularity; excess of lymphatic elements; muscular trauma on infected utricular glands.

Pathologic results: Deposit of connective tissue; hypertrophy; atrophy.

Clinical results: Pain; menstrual disturbance; sterility; hemorrhage; prolapse; reflex irritation.

The predisposition of the uterus, over other hollow organs, to inflammation is because the uterus has no submucosa and hence the mucosa and muscularis do not move independently as in the stomach. The utricular glands penetrate the muscularis directly and thus can be traumatized directly by muscular contractions and induce consequent direct infection.

100 State Street.

THE TECHNIQUE OF PIROGOFF'S AMPUTATION OF THE FOOT.

Presented to the Section on Surgery and Anatomy at the Forty-eighth Annual Meeting of the American Medical Association, held at Philadelphia, Pa., June 1-4, 1897.

BY GWILYM G. DAVIS, M.D., M.R.C.S., ENG.

SURGEON TO THE EPISCOPAL, ST. JOSEPH'S AND ORTHOPEDIC HOSPITALS, PHILADELPHIA.

Pirogoff was the celebrated Russian surgeon of the Crimean War. He was the surgeon in charge of the Russian forces at Sebastopol, and it was in 1852 that he devised his operation of osteoplastic amputation of the foot. His contemporary, Syme of Edinburgh, had not long previously given to the world his equally famous method of amputating the foot and, not unnaturally, in a clinical lecture on the subject (*Lancet*, Vol. I, 1855, p. 307), explained the superiority of his operation to that of Pirogoff. The only practical difference between the two operations was that Pirogoff retained a piece of calcaneum in the heel flap, while Syme dissected it out.

I have ventured to bring this operation to your notice because it appears to me to be one of great merit, particularly in cases of railroad injuries, and because the satisfaction to be derived from it will depend largely on the manner in which it is performed.

Judging from a long period of observation of the operation, as done on the cadaver in classes in operative surgery, and also as done on the living body, it is apt to be both a tedious and slovenly performance, and the subsequent results to the living are not so good as would be the case had more care been bestowed on its doing.

Pirogoff's original communication appeared in his work entitled "Klinische Chirurgie: Eine Sammlung von Monographien, über die wichtigsten Gegenstände der praktische Chirurgie," Leipzig, 1854. It is rarely alluded to; even he himself in his work on military surgery does not state where he published it. Fortunately, T. Spencer Wells (*Medical Times and Gazette*, March 20, 1858, p. 288) gives a translation of the original article. Pirogoff's own description is given by Wells as follows: "I commence my incision close in front of the outer malleolus, carry it vertically downward to the sole of the foot, then transversely across the sole, and lastly obliquely upward to the inner malleolus, where I terminate it a couple of lines anterior to the malleolus. Thus all the soft parts are divided at once quite down to the os calcis. I now connect the outer and inner extremity of this first incision by a second semilunar incision, the convexity of which looks forward, carried a few lines anterior to the tibio-tarsal articulation. I cut through all the soft parts at once down to the bones, and then proceed to open the joint from the front, cutting through the lateral ligaments, and thus exarticulate the head of the astragalus. I now place a small narrow amputating saw obliquely upon the os calcis behind the astragalus, exactly upon the sustentaculum tali, and saw through the os calcis so that the saw passes into the first incision through the soft parts. Saw carefully, or the anterior surface of the tendo Achillis, which is only covered by a layer of fat and a thin fibrous sheath, might be injured." "Lastly," says Pirogoff, "I separate the short anterior flap from the two malleoli, and saw through them at the same time close to their base. I turn this flap forward, and bring the cut surface of the os calcis in apposition with the anterior surface of the tibia. If the latter be diseased

it is sometimes necessary to saw off from it a thin slice with the malleoli." This translation is almost exactly as given by Sedillot ("Contributions à la Chirurgie," Vol. II, p. 194), where Pirogoff's entire article can be found in French.

The principal change suggested in the operation was either by Dr. Eben Watson, Surgeon in the Royal Infirmary of Glasgow, and published in the *Lancet* of June 11, 1859, or by William Pirrie, Professor of Surgery in the University of Aberdeen, and published in the later editions of his "Surgery," or perhaps by both independently. It consisted in making the incision from the tip of one malleolus across the sole of the foot to the other, then sawing through the calcaneum upward and backward. The incision is prolonged up behind the ankle joint and carried across the front to the opposite side. The leg bones are then sawn through just above the ankle joint. Watson advised that the section of the leg bones be made downward and forward, but all other operators have recommended that more of the posterior edge should be removed.

The technique now suggested is as follows, the left foot being the one to be operated on: The foot resting on its outer side, sink the knife into the tissues of the sole and side of the heel, down to bone, on a line with the posterior edge of the internal malleolus, and prolong the incision directly upward to the upper edge of the swell of the ankle; this will be about three centimeters, or an inch and an eighth above the tip of the malleolus. Turn the foot on its inner side and, grasping the heel with the left hand, continue the incision across the sole of the foot and up the outer side along the posterior edge of the external malleolus and fibula until it reaches a point opposite to the ending of the first incision. The foot, resting on its heel is now firmly extended and the two ends of the side incisions joined by another curved one, forming an anterior flap one inch in length. This is turned back, and by a touch of the knife on each side the tissues are separated from the posterior surface of the bones sufficiently to allow the passage of a director or other instrument to prevent the tissues being injured by the saw. The leg bones are now sawn through just above the swell of the ankle, the posterior flap separated downward by a few strokes of the knife and the calcaneum sawn through in the line of the skin incision. The projecting outer corner of the fibula is removed, and the fragment of the calcaneum is to be brought upward, fastened securely to the tibia by means of chromicized catgut passed through holes in the bones, and the skin wound closed by interrupted sutures without drainage.

The incision across the sole of the foot is placed farther back than is that of Pirogoff, or of Watson's or Pirrie's modification. In them, in order to divide the calcaneum it is necessary to place the saw so far behind the line of incision that the flap will be torn unless it is retracted. It is to avoid this that Treves, Agnew and others have advised that the heel flap be dissected back a quarter of an inch or more. It is difficult and troublesome to saw the bone under these conditions, and is not required if the two ends of the plantar incision are carried along the posterior edges of the malleoli. Placing the incision so far back does not endanger the artery, for the two are still separated by the tendons of the tibialis posticus and flexor longus digitorum.

The plantar incision is prolonged upward to the upper edge of the swell of the ankle, in order to allow of a high section of the bones. The anterior flap is made an inch long, in order to allow for the retraction which takes place consequent on making the incision while the foot is in an extended position. The bones are sawn through at a higher level than usual, in order to make a thinner and shorter stump. This reduces the difference in width between the two ankles when an artificial foot is worn, and renders the deformity less conspicuous. It also raises the stump sufficiently to allow of a cylindric joint being used instead of two side joints, thus adding to the strength and durability of the appliance. By making the section of the bones in the manner described, an ordinary amputation saw can be used in the usual manner. It is not necessary to use a small saw with a movable back as advised by Heath, nor a small narrow saw as did Pirogoff, nor a Butcher's saw as recommended by others.

The high section of the leg bones always allows the heel flaps to be brought up into position without any tension on the tendo Achillis. To avoid and remove any tension on the tendo Achillis, Pirogoff advised removing, if necessary, an additional slice from the tibia. Sedillot, Busk and Günther advised an oblique section of the bones. Sir William Ferguson ("Practical Surgery," p. 427) advised section of the tendon for the same reason. He said: "I am so satisfied of the advantage of dividing the tendo Achillis in this operation that I recommend it as a preliminary step, to be performed much as in a case of talipes." Agnew also (Vol. II, p. 360) advised its division in case the bone did not readily come into place. Addinell Hewson, Sr. (*American Journal of the Medical Sciences*, 1864, II, p. 121), to whom we largely owe the popularization of this operation in this city and country, was accustomed to apply a broad piece of adhesive plaster to the back of the leg to prevent the calf muscles from drawing the calcaneum up. These facts are sufficient evidence that inability to approximate the sawn bones is of frequent occurrence in this operation as usually performed.

Mr. Jacobson, in his "Operative Surgery," advises fastening the calcaneum to the tibia with chromic catgut or silver wire. This I have made a practice of doing, preferring the chromic catgut. It prevents displacement and insures better and quicker union of the bones.

Removal of the foot by sawing the bones instead of disarticulating, originally suggested by Watson or Pirrie, adds greatly to the ease and quickness of the operation. A high section of the leg bones obviates the necessity of clearing the malleoli of the soft tissues for the application of the saw.

In the performance of the operation as here described, it can be done easily and quickly; the foot can be removed without undue haste in less than three minutes; no difficulty is experienced in the application of the saw; the edges of the flaps are not lacerated by it: the bone comes readily into place; and the resulting stump is the best possible for a serviceable and artistic artificial appliance.

255 S. Sixteenth Street.

Menthol Collodion for Contusions is recommended by Namé to soothe pain and accelerate recovery. After rigorous antisepsis and cleansing of the contused parts with ether, they are painted once or twice a day with a mixture of 24 to 27 grams of collodion with 6 to 8 grams of menthol.—*Journal de M. de P.*, September 12.

MORBUS COXARIUS, EXSECTION.

Presented to the Section on Surgery and Anatomy at the Forty-eighth Annual Meeting of the American Medical Association, held at Philadelphia, Pa., June 1-4, 1897.

BY JAMES W. COKENOWER, A.M., M.D.

SECRETARY IOWA STATE MEDICAL SOCIETY; LECTURER ON ORTHOPEDIC SURGERY, COLLEGE OF PHYSICIANS AND SURGEONS, MEDICAL DEPARTMENT OF DRAKE UNIVERSITY.

DES MOINES, IOWA.

It is not the purpose of this paper to catalogue the views of authors on the subject, for the consensus of evidence is strongly in favor of the osseous origin in children, while in adults synovitis is more common; and the former usually originate in osteomyelitis of the end of the bone, while the latter commences in the synovial membrane A majority of authors believe the disease to be invariably the result of a contaminated constitution and essentially strumous in its origin, while a few others claim traumatism as the cause and cite cases that have gone through the different stages of the disease, with anchylosed joint, but lived to a vigorous, robust old age; when if every case had been tubercular, or of a strumatic diathesis, this could not be. I believe many latent cases of coxarius, which might never have been manifested, have been so by traumatism and have passed through the different stages; thereby with disastrous results. I do not believe, however, the disease ever begins in the cartilages of the joint, because they contain neither blood vessels nor nerves, and necrosis occurs secondarily in the cartilages, on account of the loss of nervous and vascular supply to the tissues which they depend upon for nutrition. It is not so necessary to know the exact origin and location of the disease as it is to know the best and quickest means to overcome it from what we do know and leave the patient in the best possible condition, and to that end I will give a brief outline of the treatment which has proven most satisfactory in my hands.

The first thing to be done after immobilization of the joint and limb is to remove the pressure from the former by extension and counter extension, not in a line of the normal axis of the limb, but in the line of the deformity, augmented by lateral traction, which will better serve to take the pressure from the intra-articular membranes; which is not wholly for the purpose of remedying the deformity that may exist at that time, but to retard and prohibit, if possible, the destruction of tissue, that whatever deformity then existing may not be increased. The idea that convalescence should be interfered with simply because we wish to have no deformity, is not feasible, much less plausible, when it is easy to correct most deformities after permanent convalescence, all things being equal, and a recovery can be accomplished without any deformity it is much more preferable; but I believe if we were to give less attention to the deformity while the ravages of the disease are active and simply supplement nature in her efforts to protect we would get better results. But as it is not convenient for us to select our cases and many present themselves to us with existing deformity and acute symptoms of the disease still present it is not best to correct the deformity in such cases, for if force were employed it might exaggerate the disease and develop an abscess in some deep inaccessible part. After all that is possible has been done by means of extension, counter extension and lateral traction, and in my opinion one pound of the latter is worth five of the former, then comes the local treatment, which if too conservative will cause the patient to risk his life in the hope that absorption and elimination will come to the rescue; so the best way would be to treat all abscesses or sinuses by cleaning out, curetting, asepticizing and drainage; but all these are secondary to the real trouble and are but symptoms, the lesion being in the bone no matter whether this be pure or mixed tuberculosis, or staphylococcus abscess. There was no object in any operative work that did not aim to remove the focus in the bone, nor was there any local treatment that did not strive to accomplish the same, and when this fails I have no hesitancy in performing osteotomy or excision.

Report of case.—A. B., aged 9 years, had hip disease for over a year, the supposed cause being a slight injury received while recovering from an attack of typhoid fever. The case was first brought to my notice Jan. 10, 1896, and presented the usual appearance of third-stage hip disease, the leg and thigh being well drawn up and adducted across the other thigh. Several sinuses existed, through which the crepitous dead bone could be reached; a free incision over the trochanter major united the sinuses, which were curetted and cleaned out, and from the condition of the continuity of the joint I concluded that exsection was the proper thing to do. After preparing the field of operation, the head of the femur was luxated and sawed off at trochanter minor and several pieces of bone were removed from the acetabulum and the whole of the denuded surfaces thoroughly curetted and aseptically dressed and, for the want of anything better, the patient was put on a wooden substitute for "wire breeches," with the limb in normal position, with extension and counter traction. The patient began at once to improve and continued to do so, the wound healed nicely and in four months the boy began to walk, with the assistance of crutches. Passive motion was gradually made. In six months he dispensed with crutches and could get around as nimbly as most boys, having good motion and but one inch shortening.

I believe, as Dr. Phelps of New York said, in 1895, at Washington: "We are all endeavoring to avoid excision, yet there are cases where the demand is imperative." The percentage of deaths in exsection of the hip joint is so low and the subsequent usefulness of the limb so satisfactory that I am of the opinion that we should not hesitate to operate upon all cases that need it and never permit a limb to anchylose in any position, except that which will render it the most useful.

THE SUCCESSFUL TREATMENT OF SNAKE BITE.

BY J. G. TUTEN, M.D.

JESUP, GA.

June 1, 1896. M. O., aged 26 years, was bitten by a rattlesnake inside of gastrocnemius muscle of right leg four hours before we saw him. We found the patient suffering a great deal of pain and leg very much swollen; pulse rate 130 and very weak; respiration 48 and very much labored. The leg was very well corded in two places, one below and one above knee. I immediately made an incision two inches long at the place where the fangs entered, then a cross incision two inches long and then a circular incision, taking in the whole of the skin and muscle an inch all around where the fangs entered; then I poured in about two drachms of crude carbolic acid and about two drachms of permanganate of potash in crystals. I then gave him, hypodermically, one grain of permanganate of potash every hour for thirty-six hours and an ounce of alcohol every two hours for thirty six hours.

As soon as I gave the first potash hypodermically I put on an Esmarch bandage, commencing at the toe and putting it up to the wound. I put it on tight because the leg was very much swollen and I wanted to press out as much blood as possible at the opening cut by me. I also put on a bandage around the leg above the wound, and below tourniquet with a man at each end and made them keep the bandage tight so as to squeeze out all the blood possible.

June 2. At 7 A.M. the record showed: No stools, no sleep, urine, almost no pulse, respirations about 60. At 6 o'clock he began to sink. No radial pulse and only faint heart sounds in

cardiac region. In state of collapse. I then gave 15 gtt. tr. digitalis every two hours and 20 m. pure undiluted alcohol in twelve or fifteen different places as fast as I could give them hypodermically, and 1 grain of permanganate of potash every hour. By 8 o'clock A.M. it looked as if he would die at any moment. He was suffering a great deal of pain and the chances were so small that I released the two tourniquets and in a short time he was resting some better, but respirations were increased to very hurried panting. I kept up potash, digitalis and pure alcohol hypodermically all day and also put a tobacco poultice over the wound, as suggested by Dr. G. W. Drawdy, but do not think it did any good. The patient remained in this collapsed condition until about 7 o'clock on the morning of June 3.

June 3. At 7 A.M. the radial pulse began to reappear, although but very small and thready, but it grew steadily stronger until it could be counted by 6 P.M., when it beat 130 times to the minute. Respirations began to get slower at 7 A.M. and gradually grew slower, until by the night of June 3 they were about 30 to the minute. At 9 A.M. we gave a large enema, when the bowels moved freely; continued the potash every two hours and digitalis fifteen drops every four hours. Digitalis was given by the mouth, also one ounce of alcohol four or five times every twenty four hours. The region around the bite on the leg began to bleb up and filled up with dark sanguinous fluid, while the skin began to look gangrenous.

June 4. The record showed: Milk diet, two stools, some sleep, free urine, pulse 120, temperature 100 degrees, respirations 25. The potash was discontinued but alcohol every four hours, alternating with the above dose of digitalis every four hours was continued. He continued to grow stronger. The leg around the bite continued to get darker, embracing the inside of the calf and whole calf of leg from two inches below knee on inside to one inch below and around ankle. Foot swollen but dark in spots, but on the outside of the calf there extended a healthy section of skin about two inches wide in the lower one-third of the leg, which grew wider from there, when at the ankle the whole foot except around the inside of the ankle looked somewhat healthy.

June 5. Milk diet, stools twice, some sleep, free urine, pulse 110, temperature 99.5 degrees, respirations 24, alcohol every 4 hours, digitalis every four hours. The leg in the above described place was still darker, in fact was black. The line of demarcation was formed, extending from two inches below the knee down just to inside of the shinbone down to and one inch below the ankle, coming back up one-half inch behind the ankle, and when one and one-half inches above ankle behind, it began to spread wider, taking in the whole calf, and only lacking about two inches from meeting around on the outside of the leg. The extreme length was thirteen and one-half inches and breadth eight and one-half inches. *This* whole surface afterward sloughed off.

June 6. Milk diet, several stools, some sleep, urine very free, pulse 108, temperature 99, respirations 23, alcohol and digitalis as above. The gangrenous parts began to slough off.

June 7. Milk diet, several stools, some sleep, free urine, pulse 108, temperature 99 degrees, respirations 23; alcohol and digitalis continued as above; the gangrenous parts still sloughing.

June 8. Milk diet, stools very free, some sleep, free urine, pulse 108, temperature 99 degrees, respirations 32; alcohol and digitalis as above; sloughing very free all around where the fangs entered, the bite being in the center of the slough. Carbolized sweet oil is being used on the slough, strength 1 to 32.

June 10. Milk diet, stools very free, some sleep, free urine, pulse 108, temperature 99 degrees, respirations 22; digitalis every four hours as a stimulant, alcohol being discarded from this date; 20 grains sub. nit. bis. for the watery diarrhea every three hours; slough almost complete and dressed with carbolized sweet oil, 1 to 32.

June 12. Milk diet stools very free, some sleep, free urine, pulse 108, temperature 98.5 degrees, respiration 21; the bismuth was continued and lead and opium pills added, opium 1 gr. and lead $\frac{1}{2}$ gr. to pill, one every four hours alternating with bismuth. This controlled the bowels from this on, *i. e.*, while taking pills and bismuth, but as soon as left off the bowels would run again, so had to keep it up for about three weeks longer. Slough complete and dressed twice daily with 1 to 32 carbolized sweet oil.

June 14. Milk, grist and butter, three or four stools, seven hours sleep, free urine, pulse 104, temperature 98.5 degrees, respirations 20; digitalis, bismuth, lead and pills (opium); leg dressed twice daily with carbolized solution.

June 16. Regular diet, two to three stools, eight hours sleep, free urine, pulse 100, temperature 98.5 degrees, respirations 20; treatment continued as above.

June 18. Regular diet, two to three stools, eight hours sleep, free urine, pulse 100, temperature 98.5, respirations 20; treatment as above.

June 21. Regular diet, one to two stools, eight hours sleep, free urine, pulse 100, temperature 98.5, respirations 20; treatment as above. All around edges of slough beginning to granulate and healing from all sides. Slough only took off skin and fasciæ and part of muscle in only one place, and that was directly underneath where the fangs entered.

June 24. Regular diet, one to two stools, eight hours sleep, free urine, pulse 100, temperature 98.5 degress, respirations 20; treatment continued as above and slough healing rapidly. We wanted to skin graft, but the patient would not agree to it. Where we used pure alcohol hypodermically each place on the arms and leg has sloughed a place as large as a silver dollar. These sloughs are dressed same as leg.

June 28. Regular diet, one to two stools, eight hours sleep, free urine, pulse 100, temperature 98.5 degrees, respirations 20; treatment same as above; all sloughs healing rapidly.

July 2. Regular diet, one to two stools, eight hours sleep, free urine, pulse 100, temperature 98.5 degrees, respirations 19; treatment as above; sloughs healing rapidly.

July 9. Regular diet, one to two stools, eight hours sleep, free urine, pulse 100, temperature 98.5 degrees, respirations 19; treatment same as above; sloughs healing rapidly.

July 17. Regular diet, one to two stools, eight hours sleep, free urine, pulse 100, temperature 98.5 degrees, respirations 18; treatment same as above; slough healing rapidly. I never saw him again until August 26, when slough was more than half healed, it then being eight inches long and three and one-half inches wide. He was having intermittent fever. I gave quinin and arsenic, which broke it up at once.

March 5, 1897. The first time I have seen the patient since last August. There is still a sore one-half inch wide and three inches long, with foot swollen and leg flexed toward thigh. I advised silk elastic stocking to relieve the swelling caused from varicose veins, but the patient would not consent.

April 25. Sore same size, foot swollen, leg flexed. He consented to use silk stocking, which was put on immediately.

May 15. Raw surface almost well, swelling in foot gone and leg not near so much flexed on thigh.

I believe the permanganate of potash to be the sheet anchor, combined with alcohol and digitalis. I also know that free incisions and free bleeding from bitten parts are very necessary, and the tourniquet must never be forgotten. I would say tourniquet first, free incisions second, permanganate of potash third, Esmarch's bandage fourth, alcohol and digitalis last.

THE PHYSIOLOGY AND THERAPEUTICS OF THE THYROID GLAND AND ITS CONGENERS.

BY H. GIDEON WELLS, PH.B.

CHICAGO, ILL.

(Awarded the L. C. P. Freer medal, Rush Medical College, 1897.)

From the chemic and pathologic laboratories of Rush Medical College.

The use of the thyroid gland as a remedial agent, while one of the latest advances in therapeutics, is at the same time one of the most striking examples of the success of rational and experimental methods in therapeutics that can be cited. Its general use began but six years ago, yet within that time it has made its way to the highest rank assigned to therapeutic materials—the specific drugs. That the thyroid extract is as surely a specific in its own field as are quinin, iron and the iodids in theirs, can not be doubted when we consider the manner in which the cretin, after receiving a few tablets, shakes off its lethargy of mind and loses its repulsiveness of figure to become an actually different being; or the way the characteristic symptoms of myxedema vanish under this form of treatment

In the ascendancy of the thyroid extract to its deserved position as a therapeutic resource it has been obliged to drag with it many other preparations which,

although older in their conception, are based on entirely different grounds (the doctrine of *similia similibus*, in fact), and which association has been one of the greatest obstacles to its general use. This refers to the host of preparations commonly classed as "the animal extracts," including such articles as cerebrin, testin, ovarin, nephrin, etc., the list of one London firm containing twenty-one such preparations, including practically every organ and tissue in the body. All of them owe their presence on the market chiefly to the phenomenal success of the thyroid extract, and yet none of them, excepting possibly the extract of bone marrow and of the thymus gland, can show well authenticated clinical results that entitle them to existence. They originated with the exploded theory of Brown-Séquard that impotence could be cured by the ingestion of testicles, and would now be merely historic but for the great success of a drug belonging to the same class by the fact of its being an animal product.

The use of the thyroid gland in medicine was gradually acquired and grew step by step with our knowledge of its physiology and pathology. Up to the year 1883 nothing was known of the importance of the thyroid gland in the animal economy. Previous to that time its function was set down in the text-books as rounding out the neck, having some influence on the voice or being concerned in the production of sleep. To be sure, in 1859 Schiff[1] had reported that extirpation of the thyroid gland in dogs resulted fatally, but this fact seemed to be entirely overlooked until, in 1883, J. and A. Reverdin described the changes occurring after the removal of the thyroid gland for goiter, and identified them with the symptoms of myxedema. Previous to that time (1878), Ord had discovered that this disease bore a relation to the thyroid gland. Kocher soon followed the Reverdins with reports of many cases of operative myxedema, observing that the symptoms were most marked in young subjects. These reports caused Schiff to repeat his previous experiments, and in 1884 he reported that extirpation of the thyroid gland was not only followed by death preceded by spasms, convulsions, etc., but that this result was entirely prevented if the extirpated thyroid were implanted into the skin or peritoneal cavity of the animal. Horsley followed with experiments on monkeys, which, living longer than did the carnivora, developed a typical myxedematous condition. Later, von Eiselberg showed experimentally the relation of the thyroid to cretinism by removing the gland from newborn animals, which then developed a cretinoid condition.

The results of the implantation experiments of Schiff naturally led to the adoption of analogous procedures in human beings, and Bircher, in 1890, successfully implanted a human thyroid twice in a woman with cachexia strumipriva. At about the same time Horsley suggested the propriety of implanting the sheep's thyroid gland in cases of myxedema and cretinism. Bettencourt and Serrano, following this plan, implanted one-half of a sheep's thyroid in the inframammary region on each side of a woman suffering with myxedema, and noticed an improvement within twenty-four hours. As this improvement took place before vascularization could have begun, they suggested that it might be due to absorption of the juices escaping from the gland.

[1] The authors and papers referred to will be found grouped alphabetically at the end of this article.

Working on this basis Murray, in the same year, made the announcement that glycerin extracts of the gland, which were rendered aseptic by the addition of carbolic acid, when injected subcutaneously, produced marvelous results in a case of myxedema. From this report practically dates the therapeutic use of the thyroid gland, for this method was immediately adopted universally, and soon great numbers of cases corroborating Murray's results were reported. However, the objections to the use of the extract hypodermatically were many, and in 1892 Mackenzie and Fox independently reported that they had obtained fully as good results by administration either of the glycerin extract or the thyroid gland itself by mouth.

From its history, therefore, it is evident that the use of the thyroid gland has in every instance been based upon reliable results of scientific research, and must be considered as entirely separate from the bulk of the "animal extracts" which have no such ground for their use. The marvelous changes produced in myxedema have caused the thyroid extract to be used in nearly every skin lesion imaginable, but these applications have been mainly in the line of experiment and have in most instances been discontinued; and the same can be said of its administration in nervous diseases. But the over-wide use of every drug with a positive but limited utility is invariable, and can in no wise detract from its reputation in its own proper fields.

Before describing the physiology and therapeutic uses of the thyroid it is necessary first to consider its structure and chemic composition, since on these depends much of our knowledge of the organ, and it is along the lines of chemistry that the most important discoveries have been made.

Anatomy.—The thyroid gland consists of two lateral lobes, generally connected by an isthmus which lies across the trachea from the second to the fourth ring, the lateral lobes extending above and slightly below this level on each side. It is attached behind to the larynx and trachea by tough fibrous tissue, and in front to the depressores hyoides muscles. The isthmus is sometimes wanting—Marshall found it present in 90 per cent. of a series of sixty cases, and the writer in a series of the same size has found it present fifty-two times, or 87 per cent. In one of these cases the isthmus existed as an isolated, cherry-sized mass between the two lobes, but entirely distinct from them, and with a separate pyramid connecting it with the thyroid cartilage. This mass was in structure identical with the rest of the gland and, as will be seen later, very nicely shows the manner of development of the thyroid. The isthmus varied greatly in size, sometimes as thick and large as the lateral lobes, at others but a thin cord of glandular tissue.

Frequently a conical process, called the "pyramid of Lalouette," extends upward to be attached to the hyoid bone, thyroid cartilage, or thyro-hyoid membrane. This may arise from the isthmus or from either or both lateral lobes, its shape and size also presenting wide variations. Its frequency varies greatly according to different observers. Marshall found it in twenty-six out of sixty cases or 43 per cent.; Streckeisen in 104 out of 153 cases; Zoja in 109 out of 147 or 74 per cent.; while the writer, by careful dissection of sixty thyroids, found the pyramid thirty-six times or 60 per cent. In ten cases it arose from the right lobe, in twelve from the left, in eight from the isthmus, in five from both lobes, and in one from the left lobe

and from the isthmus. In twenty-one cases it was attached to the thyroid cartilage or thyro-hyoid membrane, and to the hyoid bone in fifteen. In one case the pyramid was split up into a chain of isolated masses of gland tissue, which would have to be classified as accessory thyroids. In structure the pyramid generally consists of regular gland tissue near its base, but the colloid material disappears as it ascends, and the vesicles become mere groups of epithelial cells which are gradually replaced by fibrous and muscular tissue, until, near the upper part of the pyramid, they disappear entirely. If the muscle fibers are numerous the upper part of the pyramid is considered as a separate muscle, and called the levator glandulæ thyroidæ. The pyramids are considered by Bland Sutton as representing part of the orignal thyro-glossal duct.

Accessory thyroids are frequently formed by detachment of small portions of the gland during its embryonic history, often by division of the pyramidal processes as in the case described. The accessory thyroids may be found anywhere between the arch of the aorta, where they are especially numerous, and the thyroid bone. Cases have been reported where they were found in the substance of the os hyoides itself.

The para-thyroids are two small bodies, first described by Sandstrom, which lie close to the lateral lobes. Kohn has described them as consisting of two pairs, an "outer epithelial body" which lies on the lateral surface, and the "inner epithelial body" on the mesial surface of each lateral lobe.

The weight of the thyroid would seem to vary greatly in different countries, since most German authors (Virchow, Rauber) place it at from 30 to 60 grams; Schäfer in England gives it as 30 to 40 grams, while the average weight of sixty glands removed from residents of this city was but 22 grams. The gland atrophies greatly in old age. In this series the gland in persons over 45 years of age was but 16 gms., while in people between 20 and 45 years it averaged 25 gms.

The thyroid is developed from two sources. 1. A median diverticulum of the pharyngeal hypoblast pushes its way downward, and forms a tube which is connected to the base of the tongue. Subsequently it becomes solid, its upper end forming the foramen cecum, from its lower end developing the isthmus, part of the lateral lobes, the pyramids of Lalouette (when they are present), and occasionally accessory thyroids. It sometimes happens that this structure remains in the adult as the "ductus lingualis." 2. From the fourth visceral cleft on each side spring pouches which pass in front of the larynx and unite with the lower end of the median diverticulum, ultimately forming the outer part of the lateral lobes.

The manner of formation of the thyroid gland explains completely its great variations in shape, and especially is this variation permitted by the fact that unlike most of the parenchymatous organs the location of its secreting structures bears no relation to any fixed outlet or duct, which arrangement must necessitate a certain limit to irregularity.

At first the gland merely consists of rod-like columns of epithelial cells, resulting from the division and branching of its original rudiments. As colloid material is formed, the walls are pushed aside, and at some time in the period of development the original continuous tubes become divided up into vesicles. The colloid formation begins in intra-uterine life, but the vesicles are not generally filled until some time after birth, section of the gland of a new-born child showing but few of the acini containing colloid.

In the adult the vesicles are found to be of many sizes, some distended with colloid so that their epithelium is flattened out until it resembles endothelium, others containing not a trace of colloid and consisting merely of tubes lined with columnar epithelium, which may in case of necessity become filled with colloid and converted into true follicles. They are separated by a stroma derived from the capsule of the gland, which sends in trabeculæ that break up into finer and finer divisions until they ultimately separate the individual follicles, and also form their basement membrane.

The epithelium of the thyroid is divided in three classes, which are described by Bozzi as follows:

1. Chief cells (*Hauptzellen*).—These are the most numerous. They contain bodies strongly refractive and apparently identical with the colloid material, which can be best seen when the cell is in unusual activity, as when a large portion of the gland has been removed. Many still finer bodies can be seen, which Bozzi thinks are incompletely formed colloid, although Babers and others have considered them as pigment from destroyed red blood corpuscles. Fat globules and protoplasm granules are also present. There seems to be no distinct membrane surrounding the cells, which blend with one another, their outer ends resting on the basement membrane, the inner ends lying in the colloid substance.

2. Colloid cells.—Small, low cells found in varying numbers in the different follicles. They lie scattered in groups between the chief cells, from which they are derived. They possess a more homogeneous protoplasm which is colored more intensely, somewhat resembling the colloid substance. Some preserve the form of the chief cells, others are round or oval, and the protoplasm almost destroyed or collected in a ring about the central mass which resembles colloid substance and contains characteristic vacuoles, the nucleus being pushed to one side. They often group together so as to resemble follicles, and sometimes free colloid substance is found between the cells. It is probable that the colloid cells of the first class may again become *hauptzellen*; but those of the second class whose nucleus and protoplasm are completely destroyed, probably can not. It is probable they are formed by an accumulation of colloid in the cell which can not escape because of some alteration in the cell membrane.

3. Cells undergoing retrograde metamorphosis.—These do not show accumulations of colloid. The alterations begin in the nucleus, which loses its power to retain stains, while its outline becomes less and less distinct. In the protoplasm the granules become smaller, the drops of colloid do not run together but remain long separate. The cell outline remains distinct until after all traces of the cell are lost. These forms are found where a fusion between adjacent follicles occurs and seem to be due to shutting off of nourishment.

Embryonal rests are found, especially under the capsule, but often in the gland substance itself. The cells lie without order in a connective tissue stroma, and have large, chromatin-rich nuclei and little protoplasm. Bozzi has found no alterations in embryonal rests left in small stumps of gland tissue remaining after removing the greater part of the gland, nor did their presence prevent the death of the animal.

The accessory thyroids are identical in structure with the thyroid gland itself, and are capable of hypertrophying and performing the functions of that organ when it is removed, if they be sufficient in their total volume.

The para-thyroids are composed of columns of epithelial cells, with large, deeply staining nuclei, and a rather small amount of protoplasm. They are packed closely together, separated by a stroma composed chiefly of small blood vessels, the connective tissue being very scanty. They closely resemble the carotid glands in structure, but the thyroid not at all, and it is considered by Prenant that they are derived from the fourth inner branchial cleft from which the thymus and the lateral rudiments of the thyroid are also derived. Gley believed that they represented embryonic rudiments of the thyroid and were capable of hypertrophying under necessity to take up the function of gland, and even to develop into the same structure, but these ideas have not received confirmation from more recent observers.

The thyroid receives a rich blood supply from the superior and inferior thyroid arteries, which, following the trabeculæ, break up into a meshwork of capillaries surrounding the vesicles. These capillaries in some places even penetrate the basement membrane and come in direct contact with the secreting cells. The vascularity is so great that when an active dilatation of its vessels occurs the gland increases noticeably in size, and in this condition a distinct pulsation can be felt throughout the gland. Some authors have described collections of a colloid-like substance in the veins of the gland, and suggested that this was the method by which the gland disposed of its secretion, *i.e.*, directly into the circulation. However, these appearances are probably due to accidental extravasations occurring in the handling of the gland.

There seems to be no room for doubt that the excretion of the colloid material occurs through the lymph channels, which are very numerous in the thyroid and lie in direct contact with the basement membrane of the vesicles, sometimes even with cells themselves. In their lumen, the colloid is constantly to be found, presenting all the microscopic characteristics of this material. The routes by which it reached the lumen have been for a long time in question, but Bozzi, after a study of glands thrown into a hyperactive condition, has come to the conclusion that there are three ways in which this is accomplished. He removed a large part of the thyroid gland from dogs, and then studied the stumps left in the animal for several days, which were in a state of compensatory activity, and observed the colloid material to escape as follows:

1. Sometimes the epithelium directly over a lymph vessel, where the tension is greatest because of the lack of support from behind, becomes lower and its nucleus grows smaller. The connective tissue forming the basement membrane atrophies and disappears, so that the epithelial cells become poorly nourished until they can no longer stand the intra-vesicular tension, when the colloid breaks out into the lymph channel.

2. The epithelium may become very low but without change in the nucleus, and the cells over a lymph vessel separate until only the thin basement membrane is left between it and the contents of the follicle. This membrane soon ruptures and the colloid reaches the lymph stream, in this case without loss of epithelial elements.

3. The epithelial cells may play a passive role, the colloid material being driven by pressure between the cells until it reaches the basement membrane, through which it makes its way to be taken up by the lymph capillaries.

Probably the follicle discharges only the excess of its contents when the neighboring follicles by their elasticity crowd upon its walls so that the opening becomes closed, this process being repeated whenever the intra-vesicular tension exceeds the resistance of the walls.

The contents of the follicles, even in the same gland, vary greatly. In the colloid substance itself are generally found vacuoles, of which most are probably the result of shrinkage in the hardening fluids, although in some cases they may be due to the dropping out of the contents of the follicles, at all events they are probably not present in the follicles during life. Often the refraction of the central portion of the colloid material, as well as its stain-retaining capacity, may differ from that of the periphery, so that concentric zones are formed, not unlike the corpora amylacea of the prostate in appearance. Imbedded in the colloid, one may also find epithelial cells in different stages of degeneration, especially in follicles that have united with their neighbors by destruction of the septum between them; crystals of varying size and forms; fat globules; vacuoles containing a mass of fragments staining with hematoxylin, more closely resembling minute threads of mucin than anything else and which may be derived from the breaking down of epithelial cells, or even of the colloid itself; and in very many cases numbers of red blood corpuscles in all stages of degeneration, this appearance having given rise to the theory that the thyroid was an organ concerned in the destruction of red blood corpuscles. The colloid substance itself stains red with von Gieson's acid fuchsin stain, which is said to be characteristic of this material. It also stains yellow with picric acid, and a faint pink with eosin.

The glandular structure of the thyroid is capable of great hypertrophy, which is generally compensatory, although similar changes may occur in certain forms of goiter. Halsted has performed very many experiments to ascertain the nature of this hypertrophy. He finds that it does not generally occur, in dogs at least, until after more than one-half of the gland has been removed. The vesicles then lose their circular outline, become elongated and branched, or else the outline of the walls become very irregular, with papillary processes separating sacculated recesses. The colloid material at first becomes vacuolated and shrinks, so that the walls of the vesicle are not in their usual distended condition. It gradually becomes less solid and the quantity diminishes until many alveoli contain none at all. Apparently, from lack of tension, the epithelial cells become taller and more columnar, until, combined with the changes in the outline of the walls, they may nearly fill in the entire lumen. While pursuing these studies he often observed parathyroid bodies, imbedded in hypertrophic portions of the gland, which seemed in no way affected.

Chemistry.—Since the thyroid is an organ of internal secretion it was naturally believed that by analysis of the gland itself could be found the substances produced by its secreting cells, and which were the agents by which it produced its effects. It has long been known that it contains considerable quantities of extractives, chief among them being xanthin, hypo-

LOMA LINDA LIBRARY

xanthin, kreatin, kreatinin and paralactic acid, which indicate a high degree of metabolic activity, but which could not well be the cause of its specific action. Many attempts to isolate this "active principle" were made with the idea that it was a ferment, and White and Davies obtained in this way a body that seemed to have some physiologic activity. Gourlay, working along the same lines, failed to find a ferment that would dissolve mucin, such as had been thought must be produced by the thyroid, but succeeded in isolating a nucleo-albumin which produced an intravascular clotting and which he believed was contained in the colloid. Bubnow extracted three different forms of proteid, one of them apparently a globulin, which was later isolated by Notkin, who believed that it was the toxic product of general metabolism which underwent decomposition in the thyroid gland, through the action of an enzyme therein produced.

Sigmund Fraenkel reported in the latter part of 1895, that he had isolated the active constituent in the form of a crystalline, alkaloid-like body, apparently belonging to the guanidin series and having the empirical formula $C_6H_{11}N_3O_5$. Drechsel subsequently described a body identical with that of Fraenkel which has been called "thyreo-antitoxin," and another similar to it. This thyreo-antitoxin, Fraenkel describes as a hygroscopic, crystalline substance, soluble in water and alcohol, the solution being neutral or slightly alkaline, and giving the reactions for alkaloids. Injected into animals it failed to produce an increased blood pressure but increased the pulse rate, and produced an improvement in thyroidectomized animals, which was however but temporary. While the activity of this substance can not as yet be absolutely denied, still many other observers have failed to verify Fraenkel's results.

This report of Fraenkel, which at another time would have probably attracted more attention, was eclipsed early in 1896 by the announcement of Baumann (the Freiburg chemist who has just passed away while in the renown of his greatest achievement), that he had found in the thyroid gland, not only of man but also of various animals, an amorphous body containing a large amount of iodin, and which possesses all the physiologic characteristics of the gland. Moreover, on removal of this substance the residue of the gland retained no activity whatever. This substance he named "thyroiodin."

Thyroiodin, according to Baumann, is a brownish colored, amorphous compound, which upon heating is decomposed with considerable swelling and with an odor of pyridin bases. It is almost insoluble in water; in alcohol it dissolves with difficulty. In dilute alkalies it is readily soluble and from such solutions is again precipitated by acids. Concentrated sodium hydroxid, upon heating, brings about gradual decomposition. It manifests no proteid reactions, although it is constantly found to contain phosphoric acid in organic combination, which is probably not part of the thyroiodin molecule, since it is present in as large proportion in impure as in pure thyroiodin. By analysis he ascertained that in the purest obtainable thyroiodin there was 9.3 per cent of iodin, which is probably below the true proportion, and he was able to obtain the iodin itself in crystalline form from this substance.

The methods used for its extraction depend upon the fact that it is an extremely stable body, resisting the action of boiling 10 per cent. sulphuric acid for three days, and being entirely unaffected by digestive ferments. To isolate the thyroiodin the finely chopped gland is placed in about four times its weight of 10 per cent. sulphuric acid in a flask connected with an inverted condenser, and boiled for about eight hours. On cooling the mixture it will be found that, except for the fat floating on the surface, all of the material but a brownish precipitate has gone into solution. This precipitate is the thyroiodin, although yet in an impure form. After skimming off the fat and filtering, the residue on the filter paper may be purified by a succession of extractions with boiling 85 per cent. alcohol. The filtrate also contains a little of the thyroiodin which can be obtained by nearly neutralizing with barium carbonate, filtering, and concentrating the filtrate, when most of the contained thyroiodin will be precipitated on cooling. Thyroiodin may also be obtained by acting upon the gland with an artificial gastric juice, keeping the mixture at 40 degrees C. for two days, when the thyroiodin will be left alone as a precipitate. It can then be purified as above.

The iodin was believed by Baumann to exist in combination with two proteids, the larger proportion being in combination with an albumin, the smaller with a globulin which is apparently identical with the thyreo-globulin of Bubnow and Notkin.

At the time Baumann made his announcement, Hutchinson, in England, was studying the colloid substance from a chemical standpoint, and had separated by gastric digestion a non-proteid substance which represented about 3 per cent., of the pure colloid. On the appearance of Baumann's report he investigated this substance further and found it to be thyroiodin, and moreover he was able to show that it was all contained in the colloid substance as it exists in the acini of the gland, thereby establishing that the colloid is the true secretion of the thyroid gland and contained its active constituents. He found that it contained all of the phosphorus of the colloid and most of the iodin, a small amount of the latter existing, as Baumann had believed, in some other form. As a result of his work Hutchinson concluded that the thyroid gland contained two proteids, one a nucleo-albumin which is present in small amounts, probably in the cells lining the acini; the other the colloid which contains 15.5 per cent. of nitrogen and 0.045 per cent. of phosphorus. The colloid is not allied to mucin, nor can nuclein bases or para-nuclein be obtained from it. It can be split up into two parts; a non-proteid and a proteid part, of which the former is the thyroiodin, while the latter contains a smaller amount of iodin and possesses less physiologic activity. The colloid is the only active constituent of the gland, and the extractives, which are quite abundant, have no specific action. Hutchinson believes the thyroiodin to consist of a globulin loosely united to a non-proteid body containing sulphur, phosphorus and iodin.

While Baumann was studying the chemic nature of the thyroiodin, Roos in the same laboratory subjected it to physiologic and therapeutic tests which showed it to be beyond doubt the active principle of the gland. Three or four one-milligram doses of thyroiodin showed a very decided action on goiter, which unquestionably could not have been the result of the one-tenth milligram of iodin contained therein acting simply as iodin, but must have been due to

the specific organic iodin compound acting as a compound body. It also produced all the effects ascribed to the ordinary extracts or to the gland itself, such as the toxic effects of large doses, the specific action on myxedema, and the influence on metabolism in both man and the lower animals. Moreover, Roos believed that it exercised its power more quickly than do extracts of the gland or the fresh gland when given as such, ascribing this to the gradual splitting off of the thyroiodin during digestion and the transformation of part of it into inactive substances, in contrast to the immediate absorption of the free thyroiodin. In his experiments Roos not only proved the activity of the thyroiodin, but proved that any preparations from the gland, so made that it contained none of this substance, produced no effect on goiters that were readily influenced by pure thyroiodin. He also found that its activity was destroyed by boiling with strong alkalies, and was not affected by solution in weak alkalies in the cold, nor by the action of digestive fluids.

After having demonstrated the presence of thyroiodin as a constant occurrence in the thyroid gland of both man and the lower animals, Baumann began to determine the quantity normally present in the human gland. These investigations led to very interesting and suggestive results.

His first determinations were of glands obtained in Freiburg, from natives of that vicinity. In a series of twenty-six glands he found the average dry weight to be 8.20 grams, containing in each gram 0.33 mg. of iodin or in all 2.5 mg. of iodin to each gland. Since the iodin represents 10 per cent. of the weight of the thoroiodin, the average amount of thyroiodin was 25 mg. The amount in different glands varied, in some being little more than a trace, while in four the amount was over 10 mg. and they were not included in the list. These cases were:

1. Woman dying of tuberculosis whose gland weighed 9.3 grams and contained 35.3 mg. of iodin. 2. Woman dying from carcinoma of uterus, weight of gland 6.5 grams and contained 22.9 mg. of iodin. 3. Woman, heart failure, gland weighed 10.7 grams and contained 14.9 mg. of iodin. 4. Man, heart failure, weight of gland 12 grams, iodin content 10.8 mg.

Since Baumann has proved that administration of iodin and iodin-containing foods (fish, etc.) to dogs greatly increased the amount of iodin in their thyroid glands, the possibility of these high results being due to administration of iodin previous to the death of the individuals was suggested, and in the second of these cases this was true, the woman having had iodoform dressings applied for some weeks, but in the other cases there was no evidence of iodin administration.

As is well known, Freiburg is in a district where goiter is endemic, and Baumann considered that possibly the amount of iodin might be different in regions where this disease is not prevalent, especially since he had found that goitrous glands contain but little iodin in proportion to their weight. That this theory is well founded is shown by the results of the analysis of thirty glands obtained from Hamburg, where goiter is of comparative rarity. These glands averaged 4.6 grams in weight, each gram containing 0.83 mg. of iodin, the total amount being 3.83 mg. in each gland. This is about one-half more per gland than was obtained in the Freiburg glands, whereas the weight of each gland was about one-half that of the latter. Here also were excluded four cases in which were found over 10 mg. of iodin, in only one of which was there a history of administration of iodin preparation.

Eleven glands from Berlin, where goiter is not endemic, were analyzed. They were mostly obtained from people meeting sudden death from accident or suicide. The average weight was 7.4 grams, each gram containing 0.9 mg. of iodin, giving a total of 6.6 mg. of iodin to each gland. Here the weight of the gland was nearly as high as in those obtained from Freiburg, but the amount of iodin is triple that of the latter, and double that obtained in the Hamburg glands. But it is to be considered that these glands are from people in full strength and middle age who met sudden death, while the results seem to show that the amount diminishes in old age and wasting diseases; however they contain three times as much iodin as do the glands from Freiburg suicides. In this series two cases were excluded; one a goitrous gland weighing 28.2 grams and containing 14.2 mg. of iodin; the other contained 22.7 mg. of iodin to only 5.4 grams of gland substance, an average to each gram of 4.2 mg.

The thyroid glands of children show, even more clearly, the variations in the iodin content in these three localities. In twelve Freiburg children under one and one-half years of age in only three glands was a trace of iodin found, amounting from 0.07 mg. to 0.18 mg., while the average weight of the glands was 1.5 grams.

The average weight of the glands from six Hamburg children was but 0.36 gram, yet five of them contained iodin, the average amount being 0.26 mg. per gland, while in the sixth a trace of iodin could be detected.

The glands of the six Berlin children averaged in weight 0.4 grams each, and five of them contained iodin, averaging 0.4 mg. to each gland.

So it follows that in Freiburg where goiter is endemic the weight of the gland is highest and the amount of iodin the lowest, in comparison with Berlin and Hamburg where it is not endemic. Therefore it is probable that there is some relation between the prevalence of goiter and the amount of iodin which is ingested by the inhabitants of the various localities, apparently an inverse ratio. This iodin may be contained in the drinking water, and in support of this idea is the popular belief that goiter depends somehow on the water supply, which has led to the theory maintained by Klebs and others that it is due to flagellata, bacteria, or other parasites residing in the water. Moreover, chemic analysis seems to indicate that the drinking water in goitrous districts really does contain less iodin than does that in other localities. The food may also be the source of the iodin, for many plants contain this element in their ashes, notably the beet root, and the same can probably be said of fish. It is a well known fact that thyroidectomized animals live much longer when fed upon vegetables than when given a pure flesh diet and the iodin content of the gland diminishes under the last regimen, either because a flesh diet prevents an accumulation of the thyroiodin, or else by its influence on metabolism it requires an increased expenditure. Again much of the iodin may be obtained from the the air, since the sea air as well as sea water contains this substance, and goiter occurs much more in the inland districts, especially when shut off from the sea winds by mountain ranges, than on the coast, as is well shown by the maps illustrating the relative distribution of goiter.

Since Baumann's work throws so much light on the relation of thyroiodin and goiter to locality, it seemed to the writer that it would be extremely interesting to determine the amount of iodin contained in the glands of residents of Chicago and of other parts of this country. As is well known, goiter can not be said to be truly endemic in any part of the United States, although Osler believes that it is endemic in the limestone region of eastern Ontario, where 288 cases were observed in a hospital population of 600, and the condition was noticeable even in the lower animals of the vicinity. Many writers, early in this century, state that goiter is endemic in the valleys of Vermont and other regions, but while this may have been true at that time it is not so now. The other thyroid diseases, *i.e.*, myxedema and cretinism, are also very uncommon, but exophthalmic goiter would seem to be slightly more prevalent. That this relative immunity from goiter in all parts of a country which contains almost every possible condition of climate, soil, water and food supply, elevation and distance from the seacoast, is due to a universally favorable condition as regards iodin supply, seems scarcely possible. It is much more likely that it is due to the migratory nature of our people and the intermarriage of people from different districts, which prevents the changes produced by long continued lack of iodin in sufficient quantities from adding up from year to year and from generation to generation, resulting in a goitrous diathesis. Possibly when the country is more thickly inhabited and its people have settled down this disease will begin to appear in certain regions, as is now observed in the older countries of Europe.

In order to find out what information could be obtained on these points by chemic analyses, it was decided to determine the iodin content of the thyroid glands of people who had spent at least a considerable part of their lives in Chicago or its immediate vicinity, and to compare them with the results obtained by analysis of the glands of residents of the different parts of the country, as Baumann had done.

For this purpose there were available the glands removed in the autopsies in the Cook County Hospital, which were especially desirable since history sheets giving information as to previous administration of iodin as well as the history of the subjects were usually obtainable. Through the courtesy of Professor Hektoen, Dr. Edwards and Dr. LeCount a large number were secured. Through the kindness of the following gentlemen glands from their respective cities have either been secured or promised: Prof. W. H. Welch of Baltimore, Prof. T. Mitchell Prudden of New York, Prof. W. T. Councilman of Boston, Professor Adami of Montreal, Dr. H. W. Cattell of Philadelphia, Dr. J. T. Eskridge of Denver, and Professor Smith of Galveston.

The glands to be examined were kept in alcohol until used, which, on account of the comparative insolubility of thyroiodin in cold alcohol, together with the immediate coagulation of the tissues, can be safely done. Analysis of the alcohol in which twenty glands had been kept for two months, showed that the loss by this means was at the most not over one-thirtieth of the total amount of the iodin contained in the glands. After this dehydration by the alcohol they can be quickly dried in the drying oven, if they first be cut up into small pieces. They are then weighed, and for purposes of analysis are ground into a fine powder in an ordinary drug-mill, an apparatus that can be easily and completely cleaned being necessary so that one gland does not become mixed with portions of the gland that was previously ground.

After considering the methods available for the estimation of iodin it was found best to adopt the colorimetric method as used by Baumann, with certain slight modifications which the writer found necessary to obtain the most accurate results. The analysis is conducted as follows:

One gram of the dried and powdered gland is placed in a covered silver crucible of 50 c.c. capacity. To this is added about 2 or 3 grams of powdered sodium hydroxid and enough water to make a thick paste. The mixture is heated cautiously, with the cover of the crucible pushed to one side to leave a crack for the escape of steam. Great care is necessary at this stage of the process, to prevent the mixture boiling too high, a catastrophe sometimes very difficult to avoid. When all the water is driven off, the cover is placed completely on, and with the least possible amount of heat the residue is carbonized. When combustible gases have ceased to escape the flame is removed and the crucible and its contents are allowed to cool slightly. Then the least possible amount of finely powdered potassium nitrate necessary to produce complete oxidation of the carbon, generally about 1 gram, is added, and after replacing the cover this is accomplished with as little heat as possible. By heating with the sodium hydroxid, the thyroiodin is decomposed and sodium iodid formed, the excess of the alkali preventing the formation of insoluble silver iodid, and also of volatile compounds of iodin.

After the residue has been cooled it is dissolved and the solution is filtered into an Ehrlenmeyer flask. This step of the process may be hastened by the use of the filter pump. To the solution is added 20 per cent. sulphuric acid until it is acidified, much carbon dioxid being given off, owing to the formation of sodium carbonate, during the fusion. On account of the presence of nitrites in the solution, as soon as the fluid becomes acid the iodin is liberated, generally in sufficient quantity to give 50 c.c of fluid about the color of normal urine. To the fluid is now added 10 c.c. of chloroform and the mixture thoroughly shaken, the chloroform settling out with the characteristic pinkish color always produced by small quantities of free iodin. The contents of the flask are now poured into one of a pair of matched cylinders, which should not be over one inch in diameter nor less than six inches in height. Into the other cylinder is poured 10 c.c. of chloroform, 15 c.c. of a saturated solution of sodium sulphate, 15 c.c. of water, and a few drops each of a 5 per cent., solution of sodium nitrite and of 20 per cent., sulphuric acid. The sodium sulphate prevents cloudiness of the chloroform after shaking, while the sodium nitrite liberates iodin from the standard solution which is to be added. The standard solutions used are two. The first contains 1 mg. of pure potassium iodid in each cubic centimeter, the second is but one-tenth as strong.

To the second cylinder is now added the standard solution from a burette, until, after shaking, the chloroform is colored to the same degree of intensity as that in the first cylinder. The amount of iodin in the specimen analyzed is then readily determined by a simple calculation based on the fact that each cubic centimeter of the stronger standard solution contains in combination 0.76 mg. of iodin. By practice differ-

ences representing one-tenth of a milligram of potassium iodid can be readily detected, best when 10 c.c. of chloroform is colored by between 1 and 2 mg. of iodin. If the unknown solution contains more iodin than this the chloroform in each cylinder can be increased to 15 or 20 c.c.

This method commends itself both for rapidity and ease of application, which are essential features in making a large number of determinations as in this case. It is also very delicate, amounts between two and three one-hundredths mg. of iodin being detected by reducing the amount of chloroform to a few drops. On the other hand it is not extremely accurate, a certain amount of loss being inevitable; but since the loss is small and the results are comparative, this is not of extreme importance.

(To be continued.)

SURGERY ONE HUNDRED YEARS AGO.

AN HISTORICAL STUDY

BY DR. GEORGE FISCHER.

DEDICATED TO THE GERMAN SURGICAL ASSOCIATION.

TRANSLATED FOR THE JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION BY CARL H. VON KLEIN, A.M., M.D.

XV.—DISEASES OF THE BONES, JOINTS AND MUSCLES.

(Continued from page 854.)

In regard to *position*, J. L. Petit taught that patients with fractures of the lower extremities must be put on mattresses (sometimes divided) and not on feather beds, and in the use of apparatus, boards should be pushed under the mattresses to prevent them from sliding; and the sound foot should be able to support itself on a block. In femur fractures he had holes made in the mattress to avoid a decubitus and that the bedpan might be pushed underneath. How often even yet are these teachings transgressed in private practice, although they have been continually preached for 170 years by the best surgeons! The bandaged fracture was almost always laid in extension. Indeed, independently of Fabr. von Aquapendente, Bromfield, Kirkland and Sharp, even in the forties and fifties, had flexed the upper thigh and laid the patient on his side; but Pott deserves the credit of having scientifically estatablished the method of the bent position also for after-treatment, and of having introduced it into general practice. When Wilmer, on the contrary, insists that Galen had already recommended the flexed position, Richter justly remarks that it is as worthy to bring to light again an old forgotten truth as to discover an entirely new one. In femur fractures Pott had the whole body turned to the injured side, laid the upper thigh with the outer surface upon a broad, hollow and cushioned splint, besides a short splint on the inner side of the thigh and fastened with the eighteen-headed bandage; the knee was somewhat bent and the foot placed a little higher than the thigh. He followed this principle of bending in all fractures, except that of the patella and of the olecranon. Pott's lateral position made a great sensation; they contended for and against it. It established itself in England quite generally, but was soon modified. Aitken had the broken thigh flexed, to be sure, but placed the patient on his back because he could not endure the lateral position for weeks at a time. On the other hand, Wilmer observed that in the dorsal position the fragments of the femur so united that the point of the foot is turned outward. In Germany, Richter adopted Pott's position, but with other surgeons preferred that of Aitken for all cases in which the injury was on the dorsal side of the thigh. He designated as a further exception to Pott's rule, the case in which the femur was broken in two places, in the middle and above the knee; then the limb must be extended, because a displacement always occurs in a bent position. The French, especially Desault, Bichat and Boyer would hear nothing of the lateral position; Dupuytren first turned his attention to it. On the first day of the injury Richter, who laid the limb on a sack filled with fine chaff, confidently gave opium; on the following six or eight days mild purgatives, and if severe inflammation was feared he bled the patient.

In *complicated fractures* a middle ground appeared between conservative treatment and amputation. Pott taught always to amputate when the bone was shattered in little pieces, the joint crushed, or the laceration of the soft parts so extreme that mortification must necessarily follow. His arguments are in part very similar to those put forward today in the question as to the treatment of gunshot wounds of the knee. He admits that conservative treatment does not always miscarry in these complications, but experience teaches that as a rule such a limb can not be preserved and the patient perishes, and the danger of amputation is never so great as that which follows such an injury. He amputated either at once, which was best, or later, when the bones did not knit, with strength exhausted by excessive suppuration, and finally when mortification threatened. If this were already present one should not amputate, because death is thus hastened, but he should assist nature to resist mortification. Allen Kirkland, who entirely approved of the other doctrines of his master as to position, splints, etc., opposed Pott's principles as to amputation. (Compare gunshot fractures in Chapter 20.) He valued them most highly in the hospitals, but not for private practice, because the country surgeons reported excellent results in complicated fractures; out of twenty cases they scarcely amputated one, and by conservative treatment they lost at most one in ten. The hospital conditions were of course of a different sort and justified amputation; the air was bad and in the hospital diet little regard could be paid to the manner of life of the individual patients. On the other hand, the patient in the country enjoyed all the advantages of fresh air and could be invigorated by beer, wine, brandy, etc., so that a cure without amputation was almost always reported. Not that alone, J. Hunter knew that it is often possible to treat a complicated fracture as a simple one. Likewise did Kirkland, who found more honor in preserving a limb than in cutting it off. Gooch, after forty years experience, asserted that mortification should never force a surgeon to a too hasty amputation, and Wilmer discarded the primary operation decisively. Richter declared himself in favor of it on account of the better prognosis, although he advised that conservative treatment be employed whenever possible. B. Bell, who regarded the principal danger as allowing the admission of outer air to the fracture, recommended secondary amputation, especially in case of after-hemorrhages where on account of inflamed swelling and coagulation of the blood a direct ligature was impossible, and also in case exhaustion ensued; for as soon as the seat of suppuration had been removed by amputation the patient improved in a striking manner (A. Monro

and Bromfield). With the secondary amputation he had often obtained a fortunate result and it had never resulted fatally, while he had seen many die from primary amputation. In general it appeared to him as necessary in private practice, but much less often than in the great hospitals and in the field.

In the interests of conservative treatment, Pott as well as Richter condemned the too hasty sawing off of the bones which protruded through the skin, since the flexed position and the enlargement of the wound often sufficed for the setting of the bones, and they sought to bring into favor splints, and the eighteen-headed bandage, which had been hitherto considered injurious. When inflammation set in, Pott applied a poultice, with which, however, in England great abuse was practiced, by applying it to simple, fresh fractures; and instead of pressing out the pus with compresses he encouraged the knife-fearing surgeons to make larger and counter openings. He laid soft dry lint in the wounds, but so loosely that it neither irritated nor checked the excretion of pus; in case of violent inflammation he resorted to bleeding, and in copious suppuration he gave strong nourishment and quinin. These methods were approved by Kirkland, only he warned against repeateded bleeding, bandaged with digestive balsam, and in order to protect the bandages from pus covered the compresses with oiled silk. Wilmer also condemned much bleeding and poulticing, and in place of the latter he early applied cooling and resolvent agents in order to avoid amputation, and also gave opium in large doses. When the Lyceum Med. in London called for a prize essay on the best treatment of complicated fractures, Weldon (1794) added to the familiar indications for amputation, those pertaining to a fracture in the joint. He bound up the injured arteries but performed an amputation, even though the injury were slight, if the bleeding vessel could not be exposed, if the hemorrhage could not be stopped, or if a ligature was impossible by reason of excessive swelling. In conservative treatment he advised the attempt to make a prima intentio when possible.

In case *no union* of the fracture resulted, White employed various remedies; one was rubbing the ends of the bones against each other, by which he healed a femur fracture in six months, after which he had the patient get up and go about on crutches. Likewise he first recommended the resection of a broken bone (1760), which he performed with success; the fracture was laid bare and both fragments sawed off, after which they were treated with caustic. Hunter had the broken bones scraped. In case of fractures healed crooked, so long as the callus was not very firm, resort was had to continuous extension; yet the rebreaking of the malformed bones, already recommended by Celsus, was practiced. In case of an angularly healed femur fracture of a child sixteen weeks old, the Dutchman Tenhaaff, sought to soften the hard callus first by poultices and quicksilver salve and then broke the bone in two, whereupon the fracture knit anew (1775.) Richter feared that in such a case the bone could easily be broken in another place.

Of particular fractures let us notice only a few which aroused special interest at that time. In no fracture were so many appliances resorted to, but with so little success, as in that of the *clavicle*. The patient was fastened to a great cross of wood or iron (Heister), indeed a new "comet" was devised for that purpose (Baas). The first step in advance was the bandage submitted by Brasdor to the Académie de chirurgie in the year 1774. In order to draw the shoulders back and hold them continuously in this position he applied a half bodice which covered the back, and, with two leather halves, drew back the shoulders. Evers improved this bandage and introduced it into Germany. Flajani, on the other hand (1785), left the patient without any bandage, and only had him lie continually on his back with the sound shoulder supported, the injured one over a hollow. Then Desault came forward with his new bandage (1787), which first gained for him a reputation in surgery. In the knowledge that the outer fragment is drawn downward by the weight of the shoulder, and forward and inward by muscles, hence it is only necessary to support the shoulder and draw the fragment outward and backward, he devised the well known wedge-shaped cushion which, placed in the armpit, brings the arm as if over a fulcrum, near the trunk below but separated from it above. In order to prevent the sinking of the fragment, B. Bell (1788), who ignored both the French inventions, was satisfied with raising the arm by means of a napkin. Finally Brünninghausen appeared with his brace (1790), which, as he said, was so easily adjusted that almost any peasant could properly cure a fracture without the help of a surgeon. He appreciated Brasdor's bandage, but disapproved Desault's method which Richter favored, and he inveighed against B. Bell. Certain fractures of the *ribs* and sternum were treated with surgical frivolity. If the broken rib pressed inward, the breast cavity was opened, and the fragment pushed outward with the finger, pincers or a spatula (B. Bell)! On the other hand, they trepanned every fracture of the *sternum* (la Martinière), because, on account of laceration and inflammation of the underlying parts, it offered conditions entirely analogous to cranial fracture. Later, trepanation was limited to cases in which it was impossible to raise the depressed fragment (B. Bell, Böttcher), or to extravasation and suppuration in the mediastinum (J. L. Petit, Richter); it was finally discarded entirely (Ch. Bell).

Desault treated fractures of the *upper arm* by adjusting a circular bandage around the arm, a forward, outer and inner splint, and a wedge-shaped cushion in the armpit, and having the forearm carried in a sling. Desault also often observed fractures of the *lower end of the forearm, with condyles*, which are not mentioned by the ancients, nor by Petit, Duverney and Bell. He introduced into general practice (1791) the treatment with the extended arm in fractures of the *olecranon*, although Duverney first suggested full extension, and the Englishman Haighton had even earlier (1785) reported a cure in this position. Desault pressed upon the fragment by envelopment and adjusted to the anterior side of the arm a splint slightly bent at the joint, to prevent flexion, but avoided too great extension. In fractures of the *forearm* they sought for means to put the four fragments against each other correctly, while the teaching of Hieronymus Brunswik, to lay the arm in perfect supination so that the patient always looks straight above him, was for a long time forgotten. They laid rolled bandages between the bones (Pouteau), cylinders an inch and a half long above and below the fracture (Richter), and even long narrow compresses from the wrist to the elbow (Aitken); the hand was kept in the position in which the patient found the

least pain, *i.e.*, half-way between pronation and supination (Richter, Bell, Desault). Desault applied small compresses to both sides, and adjusted three splints and a circular bandage from below upward.

As mentioned before, the fracture of the *upper thigh* principally brought to a close the contention over Pott's lateral position. Desault became its strongest opponent after he had twice tried it and, in spite of the most careful treatment, a considerable shortening had followed. After that he discarded it because of extension and contra-extension, of the impossibility of accurately comparing the injured thigh with the sound one, the hardship of the position after a long time, the painful pressure on the trochanter, the difficulty of defecation and the lack of a sufficient fixation of the bone. Instead of the lateral position, Desault, with the best results, made use of the continuous extension method decried by most surgeons, and then, principally with him, the perfection of the extension bandage begins. Through this method, by means of a bandage laid over the joints and a strap around the chest and shoulders, etc., the great danger of a femur fracture at the knee joint was lessened. For the rest, there was no lack of newly invented apparatus (Gooch, Theden, Aitken and others). They recognized the great difficulties of diagnosis between fracture and luxation of the upper part of the thigh, which confusion A. Paré has been honest enough to confess. Our countryman, Schneider, had devised (1768) an extension apparatus for this fracture; he passed above the knee two cords which could be drawn tightly to the bedstead by screws, while for contra-extension, two cords which fastened to a leather girdle secured around the hips and passed through the upper part of the bedstead; an outer splint prevented flexion. Desault effected extension by means of a long wooden splint attached to the outer side. It was actual abuse when Sabatier applied only a straw splint and at first did not hesitate to repeat the setting several times a day until after two or three weeks the convulsive muscle contraction ceased. Brünninghausen wrote a peculiar monograph on this fracture; he bound the injured thigh fast to the sound one and adjusted an outer splint to the upper thigh. His teachers, Richter and Siebold, and also Theden, recommended this method, which, however, had been accurately described several years before by the Dutchman, Van Gesscher ("Richter's Chir. Bibl.," XIII, 322).

The fracture of the *patella* aroused great interest by the question as to whether it could be cured at all. Hitherto denied by the Académie de Chirurgie, Camper, Sheldon, David and Böttcher pointed out the true callus, while Callisen in forty sections did not once observe the slightest trace of such a thing, but only a viscous or cartilaginous intersubstance. Aitken admitted cures in three ways, by true callus, tendinous or membranous matter. And then it was argued, pro and contra, whether a setting should be made immediately (Mohrenheim) or only after reduction of the swelling, since if one has no control over the vessels, he can not often bring about an accurate adjustment (Pott, Bromfield, Acrel). Many attached no value whatever to bandaging, and recommended only rest and antiphlogistics (Warner). Many appliances and bandages were suggested for the accurate adjustment of the fragments in an extended position (Mohrenheim, Theden, Evers and others). Richter reported cures by a simple envelopment from the point of the foot to the abdomen, with the adjustment of a long narrow compress over the upper fragment; and Desault considered a bandage applied in extension as sufficient. At the end of the second or third week, passive movements were begun (B. Bell, Bromfield), to guard against a persistent stiffness. Posch (1774) facilitated the treatment of fractures of the *lower part of the leg* by his so-called Fussbett (foot-bed) in which the broken limb hung in suspension by straps, and could be extended by means of cords at the knee and foot. This apparatus received much applause in Germany. An appliance of Pieropanos of Vicenza came into use in Italy (1780); it effected extension by means of long screws on a brass plate which bore a shoe. This appliance was introduced into all the hospitals of Venice and of the kingdom of Naples; indeed, the High Council of Venice had gold and silver medals struck in honor of the inventor.

In *caries* Alexander Monro, senior, first called attention to the analogous process of the formation of abscesses in the soft parts. Richter distinguished between dry (Petit's designation) and moist caries, divided the latter, according to the nature of the soft parts, into hidden and open, and admitted moreover a malignant caries, which either as spina ventosa has its seat in the spongy bones, or as exostosis maligna is a completely ulcerated abscess of the bone. For the cure of caries only a separation of dead from living bone was necessary, which they endeavored to accomplish by means of instruments, or which was left to nature by exfoliation. To accelerate the latter process, they moistened the part with brandy or liq. bellostii, used the hot iron, bored into the bone and injected those liquids, or they removed the diseased part by means of a scraper, chisel or trepan. The recently much discussed *évidement des os*, according to Sédillot, is nothing new, since Heister recommended the scraping out of the foul matter with scraper and chisel until one should come to healthy bone substance. Amputation, recommended by J. L. Petit in persistent caries, was only allowed when the caries had completely laid hold of a large bone shaft or a joint, and the soft parts were at the same time corroded. In caries following gunshot fractures, Bilguer had been able to avoid amputation and, as we have seen in the last chapter, restricted his treatment to the so-called *évidement*, scraping out and a complete extirpation of the separate wrist and ankle bones, a treatment which is customary even today. If the soft parts had suffered only a little, resection was recommended. Richter also favored this, since nature replaces the lost piece, and the limb not only retains its former length, but also the movement of the joint.

Pott discovered caries of the vertebral column *malum Pottii*, and described it in a masterly manner Hitherto the paralysis of the lower extremities, arising from this disease, had been regarded as the result of an unnatural curvature of the spine, so that no one considered any treatment but to straighten the spinal column by means of instruments. His attention was aroused when he observed the paralysis leave a child and a cure take place after opening an abscess on the spine supposed to be fortuitous. Although he designated the disease as paralysis (palsy of the lower limbs), yet he did not suppose that it was the result of a lump on the neck, back or hip, but that both depended on an as yet unknown cause. Then by dissection he found, in the extreme stage of the disease, the vertebral matter entirely carious; in a disease of short duration it was only swollen, and the ligaments

thick and flaccid. Chance defined his treatment, which has become classic. In Worcester, Dr. Cameron related to Pott that an observation of Hippocrates, in which a paralysis of the legs is regarded as caused by an abscess of the spine, had induced him to make an artificial ulcer near the hump in a similar case whereupon a complete cure followed. A surgeon of that place, Jeffreys, confirmed this and asserted that he had had similar results. This induced Pott to apply to both sides of the hump a seton or an issue made with a corrosive, and often kept it flowing several months until the patient was able to walk about. He saw many cases of paralysis cured under this treatment. Sometimes the humps disappeared entirely and the constitution improved, and he recommended applying the issue as early as possible, because in fully developed caries the disease was incurable. In the same year as we have mentioned before, David in Rouen made his observations public and remarked that caries of the vertebral column is not incurable and that the process of cure is the work of nature, time and rest. When Bouvier first snatched this work from oblivion (1858) he established for his modest countryman the honor of priority and reviled Pott as a blattant braggart in every way. Michaelis was an eye-witness of almost twenty successful cases in Bartholomew's Hospital, and he immediately reported them in Germany. It is astonishing that Richter found no word of recognition for the great discovery of his highly esteemed teacher, and even said that this disease was not frequent with us. This was known scarcely four years when the treatment began to deteriorate. It had already come to pass that Pouteau replaced the issues with moxa, which Desault also preferred; but Sheldrake taught anew the dangerous doctrine that an apparatus should be applied to the patient to correct the curvature of the spine. Although B. Bell was quickly at hand to banish all apparatus as in the highest degree injurious, yet throughout many decades that doctrine wrought disaster. Bell had the patients sleep on horsehair mattresses with boards underneath, never on feather beds, in order that the body might lie as nearly horizontal as possible, and he had them discontinue all tonics and cold baths. In this way one could check the disease in the beginning, for as soon as the bones were attacked a perfect cure could not be accomplished, and whenever the issues were successful the disease had had its seat only in the ligaments, not in the bones themselves. Ford also discarded the apparatus because they separated the vertebral substance and prevented ankylosis. He found that the results of the artificial ulcers were better the higher up the curvature was. According to Loder, who attached great importance to the early recognition of the disease, if one suspected the beginning of caries, the only help lay in an incision reaching to the bone, which should be transformed into an issue; superficial ulcer, even moxa, availed nothing.

Necrosis was described by Ruysch and Jacob von Meekren; but the older surgeons regarded it as only a special form of caries, and until recently the two diseases were not always sharply defined. Troja produced necrosis artificially in animals, and found that one could accelerate the formation of a new bone in no way more surely and rapidly than by completely destroying the marrow in the old. Upon this he established trepanation of bone cavities. Multifarious experiments on animals were made in order to clear up the dark question of the regeneration of bones; this was especially so in Germany on the part of Blumenbach and Roeler. The latter, a pupil of Richter, sawed off the caput femoris with the trochanter major of dogs (1786), and found the result important for the reconstruction question in that the animal could run about again after four weeks. In postmortem no new head was found, to be sure, but on the sawed ends there were many rounded protuberances of bone, from which new tendinous ligaments proceeded to the edge of the hip socket where they had grown fast. David produced the first scientific pathologic work on the disease to which Louis gave the name necrosis ("Obs. sur une maladie d'os connue sous le nom de necrose," Rouen, 1782). In it he disputed with a colleague who considered the experiments of Troja and others as to the formation of new bone as erroneous, and the operation of taking the old bone out of the new cylinder as useless. David regarded necrosis as a disease of the periosteum. If the periosteum becomes bruised inflammation arises, from which pus exudes between it and the bone and the two are separated. Then the exposed bone mortifies, the periosteum swells from the newly supplied fluids, becomes thicker, at last ossifies and forms a new shaft around the dead bone. The many fistulous openings in the new cylinder arise from the pus which at first corrodes the periosteum and forces its way outward; through them the sequestrum can be seen and drawn out. Formerly they had bored great holes into the case of the tibia with the trepan and cauterized the bone (J. v. Meekren, J. L. Petit). David first performed necrotomy by means of a hammer and chisel and drew the sequestrum out. For example he extracted ends from the humerus and tibia, a piece seven inches long from the femur, and advised afterward that the hot iron be applied to the entire inner cavity of the bone. With this operation, which he recommended early, he avoided the hitherto frequently employed amputation. In England Walker, who likewise considered amputation unnecessary, had performed this operation successfully for many years; once he trepanned the humerus in almost its entire length so that it lay open before him, and removed the sequestrum. Bousselin called attention (1785) to the fact that sometimes after months and years nature is able to loosen and discard the sequestrum, and the fistulas heal of themselves; but before the operation one must convince himself of the movableness of the sequestrum. Desault once opened the entire tibia with a chisel, and extracted a sequestrum which extended nearly the whole length of the bone; the fissure was filled with rolls of lint, and after fifteen months the patient was able to walk. Weidmann produced the first detailed work in Germany ("de necrosi ossium," 1793). He distinguished sharply between caries and necrosis, as between abscesses and inflammation, and included under necrosis mortification and disjunction of the bone, without considering, with David, a replacement by new bone substance was necessary. But that nature could replace the disjoined pieces of bone, Weidmann and Percy observed in the lower jaw, Moreau in the clavicle, Chopart in the shoulder-blade, and Warner after the extraction of an entire tibia which was completely regenerated. For the formation of bone it is first of all necessary that the periosteum, as the chief source of nourishment, be preserved. Hence Weidmann, who introduced the name cloaca, advised "in all operations in which one

endeavors to separate and extract the pieces of dead bone, to spare the periosteum as much as possible." (C. C. v. Siebold separated the periosteum with a spatula before he applied the trepan to the bones.) He has the credit of having introduced sequestrotomy into general practice, although it struggled long for admittance; even Dieffenbach regarded the operation as dangerous and refused to use the chisel.

J. L. Petit offered the first observations as to the purulent *osteomyelitis* appearing after injuries. The one concerned a simple contusion, the other a gunshot wound in the tibia; in both cases death ensued under serious circumstances, and along with liver abscesses a suppuration of the marrow cylinder was found. The history of *abscesses in the bone* also goes back to J. L. Petit; he saw such an abscess on the tibia in syphilis, and first cured it when he cut out a great piece of the bone by application of four trepanations (1723). *Exostoses*, if they were not based on dyscrasia, were in special maladies removed with the chisel or trepan; on the other hand if they surrounded the bone the entire piece was sawed out, an operation which Richter in general rejected as too dangerous. J. L. Petit had already operated for cranial exostosis.

In the teaching as to *luxations*, until the eighteenth century brute force alone prevailed; the invention of new apparatus was for the most part the main object. Many of them were better adapted to tear out a limb than to set it, and most of them so constructed that one was not able to control them. Here, too, we owe the greatest progress to foreigners. J. L. Petit recalled the method of the ancients to bring a joint back into place in the same way in which it had been wrenched from the socket by the capsular opening, or as White expressed it, to set the limb again in the same position and direction in which it was dislocated. Petit had extension and contra-extension applied equally, but brought them to bear gradually on the dislocated limb itself, and the binding cord approached the condyles, which were protected by bandages. It was a great merit of Pott that he condemned the forcible tractions by apparatus, and esteemed the skill of surgeons above them. Especially through him the question as to the retention of the ligaments of the joint in luxations, was raised. He regarded them as very extensible so that they could bear a great strain, and therefore were seldom lacerated. However, the setting of a fresh luxation does not prevent laceration, for within twenty years in his great hospital he had never seen a luxation of the humerus which could not in time be adjusted, in which, to be sure, a laceration of the ligaments of the joint had sometimes taken place. On the other hand, B. Bell and Kirkland brought forward the fact that the capsule might remain uninjured in incomplete luxations, but not so in complete luxations, even sometimes being torn away from the bone. The difficulty in setting dislocations of long standing, Bell recognized principally in the fact that fat, muscles and cellular tissue crowded into the socket and prevented the bone from resuming its former position. In setting Pott had the force applied to the dislocated bone itself, and gradually increased, and he emphasized as a most important general principle, that all the muscles should be relaxed as far as possible by a proper position. With this object bleedings were made (Flajani, Loder), and purgatives (Yonge) and tartar emetic enough to cause nausea (Chessner 1787) recommended. After setting it they allowed the limb to lie unmoved for a few weeks that the capsule might reunite with the neck of the bone; if the limb was moved too soon the union was imperfect and the joint weak, and a slight cause might dislocate it again. In case of severe contusion inflammation and swelling of the soft parts, setting was postponed until these conditions were moderated by rest, a somewhat bent position, and leeches (Pott). When in a slight injury the relaxation of the ligaments of the joint had the greatest share in bringing about the luxation, cold baths and electricity were recommended (B. Bell). A large part of the hitherto surviving apparatus was discarded. For that purpose in Germany there came into use the crane of the Saxon regimental surgeon Mennel, who added to the pulley used by Schneider, a screw arrangement and crank (*Loder's Journ. f. Chir., iii*); this is almost the only appliance of which later times still make use. The danger and uselessness of setting old luxations were well known. When David set a luxation of the humerus several months old, inflammation and death followed the great violence employed. His specimens of shoulder joints, as well as Loder's of hip-joints, show examples of new and completely formed joint sockets in case of luxations of long standing. In case of complications with fractures, setting of the luxation was recommended to be first undertaken. On the other hand if the fracture was close to the dislocated joint Bötcher had the bone set first and the dislocation was not corrected until after the healing of the fracture, but on the extension of the fracture he sometimes observed that the ball of the joint immediately re-entered the socket. When the head had protruded through the skin Gooch advised that it be sawed off, in support of which Kirkland supplied some favorable observations showing that it preserved the use of the limb completely and intact.

Today physicians warn against lifting a child by the head "in order to show him the geese of Bremen," because death might result suddenly from *dislocation of the vertebræ* of the neck; 170 years ago that nonsensical custom, called "showing children their grandfathers," was very popular among the common people and was severely criticized by J. L. Petit on the above ground. He also showed that dislocation of the first cervical vertebra was the cause of death in hanging. This dislocation was known to have been successfully set in a few cases; the Englishman Harrup accomplished it by extension accompanied by audible crackling; Ehrlich also undertook it in life and death cases, and Desault made the reduction in the case of a child, with the remark that life depended on it. As an avidence that this dislocation does not always result fatally, Callisen, in making a postmortem found, by chance, an ankylosis of the third and fourth cervical vertebræ which had been wedged together. Sömmering (1793) wrote on luxations and fractures of the *dorsal vertebræ* and showed that the joint ligaments often resisted external violence more strongly than the bones, that one of the vertebræ could be dislocated in relation to its entire environment without causing sudden death, and that generally such an injury could be repaired. For a long time the possibility of this dislocation had been generally doubted (Duverney), or at least it had been thought hardly possible without a simultaneous fracture and immediate death, because it was always accompanied with laceration of the spinal marrow (B. Bell). Enaux (1784) observed the very rarely occurring dislocation of the *pelvic bones* in which the

left os pubis stood two fingers' breadth higher than the right one; after a brief antiphlogistic treatment the patient walked about on crutches, whereupon the weight of the bone gradually effected the reduction and recovery ensued. J. L. Petit set luxation of the *coccyx* by inserting the finger into the anus.

In case of luxation of the *lower jaw* Petit recommended the old practice of placing the two thumbs upon the teeth farthest back and pressing downward and then backward; it was also advised that before pressing the jaw down it be first drawn somewhat forward in order to make it mobile, and that the thumbs be protected by thimbles (B. Bell). In spite of Petit's opposition, Heister advised a severe blow upon the sound side of the face, as an approved method. Ravaton had observed that in case of an imperfect setting of a one-sided luxation, chewing and talking might later be made difficult and even impossible. Zach. Vogel made the rare observation of a luxation in a backward direction ("Merkwürd. Krankengesch. 1. Samml," 1756, S. 150), concerning the possibility of which Petit and Monro had doubts. Loder would not deny this possibility, especially in imperfect formations, because in one of his specimens the joint-process was considerably lower and smaller on one side than on the other, thereby making possible such a displacement. Our time considered the backward luxation, without a simultaneous fracture of the anterior wall of the external passage of the ear, as impossible, until Croker King saw the condyle dislocated in a backward and upward direction, in consequence of a fall, without any fracture of the ear passage (1855; S. Weber in "Pitha-Billroth's Handbuch"). Aurran of Rouen (1771) first described luxation of the *sternum*.

J. L. Petit recognized forward, backward and under luxations of the *upper arm*, and described nine methods of reduction, among them especially that in a horizontal direction, which soon found favor (Heister among others). Charles White suggested extension upward, after the setting with the heel, a method which is usually ascribed to Astley Cooper, had often disappointed him, and he reported very many successes by the former method, especially in old cases. To be sure, he opposed Pott's rule of bending the forearm, but his idea was to use the arm as a lever which can exercise the greater force the longer it is. This method of vertical extension was first established scientifically by Mothe in Lyons. Desault recommended direct reposition, already known to Avicenna, by which the reduction was accomplished only by immediate pressure of the fingers upon the ball of the joint. Richter attached great importance to frequently changing the direction of the extension, applying a moderate force and in case the ball was dislocated forward or backward, he advised always drawing it a little downward before forcing it into the socket, in order to bring it back again in the same direction in which it was thrown out. In very energetic experiments in extension, Desault maintained that he had seen the development of an emphysema as large as a man's head, within a few minutes, and had at first thought it an aneurysm arising from the laceration of the art. axillaris. The setting of a luxation of the *elbow* in the backward direction required chiefly the bending the forearm during the extension (B. Bell). J. L. Petit admitted the possibility of a luxation in a backward direction; he also cured a case in which the lower end of the humerus had broken through the skin. He regarded the dislocation of the *wrist* as one of the most dangerous, because the reduction was quite difficult and the after-treatment long continued, while pains and an inequality in the joint remain, which cause many to believe that the setting was badly done or that a fracture had occurred. Soon doubts as to the frequency of this luxation were expressed (Pouteau and Desault), until Dupuytren denied it entirely and declared it to be a radial fracture. Desault first described a luxation de l'extrémité inférieure du radius, which Loder also afterward observed. The difficulty of setting a dislocated thumb was recognized by J. L. Petit and by Richter, who once worried himself an hour and a half over such a case. For this purpose the tendons and ligaments were severed (Desault) and in unsuccessful reduction amputation even was performed.

Petit described very accurately the luxations of the *upper thigh* in the four directions, upward and inward, upward and outward, downward and inward, downward and outward. B. Bell regarded as the most frequent kind that at the foramen ovale, which was the only one he had often seen, while the upward luxation seemed to him of very rare occurrence, indeed, almost impossible on account of the projecting rim of the socket. They abandoned reduction in the exact direction of the thigh, which had by that time brought into use every kind of instrument of torture, and they recognized the necessity of a flexion of the femur at a right angle, to which Hippocrates had already referred (Kirkland and Pouteau). Indeed, Anderson increased the flexion to an acute angle, and in that way set inward, outward and backward luxations (1775). It is well known that seventy years later Fischer of Cologne insisted anew upon this acute angular flexion. When the muscles were badly strained, especially in long-standing luxations, Vermandois anticipated much from a gradual extension exercised by appliances, but Richter was doubtful of success. In luxation of the *patella*, while Benjamin Bell considered an inward direction as the more frequent, because the inner condyle of the femur is lower than the outer, Richter found that when the luxation occurred in riding the patella was always dislocated outwardly. The occasionally great difficulty in setting such a luxation is shown by one case in which Sabatier abandoned his efforts at reposition and called upon Boyer for help. The German surgeon, Schneider, saw the rarely occurring luxation of the *lower leg* (*Chir. Gesch.*, 9. Theil, 1781); the femur condyles were behind and below, the tibia in front and above, and the leg was shortened three inches, so that the soft part behind was so strained that a laceration was feared; the reduction followed easily. Bromfield corrected the dislocation of one of the two crescent-shaped cartilages in the knee joint by alternately flexing and extending the foot gently. In a complicated luxation of the *talus*, in which it was torn loose and forced into the wound, Laumonier and Desault extracted the bone successfully. *Congenital luxations* of the hip and shoulder joints, mentioned by Hippocrates, are described by J. L. Petit and Heister, and by Verduc, who regarded the attempts at reduction as an evidence of unskilfulness of the surgeon. Löffler of St. Petersburg published a work on diastasis of the bones ("Richter's chir. Bibl.," xiv, S. 301, 1795).

The field of *inflammation of the joints* lay entirely fallow until within the second half of the last century. Here, also progress first arose in England. If we ex-

cept one of the most precious discoveries of the century, the resection of the joints, introduced by White in the year 1768 (see chapter xx), we find as the most conspicuous publications, the works on coxitis, by Edward Ford, and on tumor albus by B. Bell. *Coxitis* was at that that time very often mistaken and treated unsuitably. Ford ("Obs. on the Disease of the Hip Joint," 1794) traced it to caries, since for a long time this inflammation of the joint was regarded as a form of disease pertaining exclusively to the hip joint. From twenty histories of cases at hand he described with great accuracy especially the first symptoms, which had hitherto always been overlooked. The child grown tired and pale, feels a slight lameness and soon begins to limp. The affected leg is longer than the healthy one, his buttock flattened and an often very severe pain appears in the knee, an extremely important symptom which, unfortunately, often gives rise to errors in diagnosis. In standing, the patient bends the knee joint somewhat and supports himself only on the point of the foot, and in the dorsal position the leg is bent and every effort to straighten it is painful. The region behind the large trochanter and that in the vicinity of the groin become sensitive. With the appearance of suppuration begins a second period, in which the pain and swelling increase and the limb becomes shorter. This condition lasts for a varying time, until the abscess breaks and hectic fever and death ensue. Then in postmortem one finds the head and neck of the femur, the socket of the joint and its vicinity carious. If the abscess does not break, which, however, is very rarely the case, the patient recovers from it with an ankylosed limb. The caries of the joint can be very considerable before the external symptoms indicate it; it is the actual cause of the disease, not the consequence of suppuration. Pain in the knee, elongation and atrophy of the thigh and pain on moving the joint distinguish it from a psoas abscess; not the bending of the thigh and the flattening of the buttocks, which are common to both diseases. A multitude of unsuitable internal and external remedies were previously recommended for coxitis. Ford favored baths of warm sea water in the first stages, but never after the appearance of suppuration; the most efficacious was the douche. Bleeding and dry cupping were employed only at first, never when caries was actually present, and it was doubtful if caries could be prevented by blisters. For the most part Ford recommended large issues with twelve to fourteen peas outside of and somewhat behind the large trochanter, and he discarded hot irons and the moxa as too painful, and likewise the seton. He saw many patients recover the complete use of their limbs under an issue. The opening of the abscess or the acceleration of its breaking was entirely opposed, as usually the most dangerous conditions follow that event closely, especially in cases of wide incisions or the insertion of tents. The pus might possibly be absorbed and the patient saved with an ankylosis; moreover, in case of spontaneous opening, the mouths of the fistulæ are so small that the patient is not suddenly exhausted. Ford regarded a certain resoluteness necessary to withstand the pressing demands of the patient and relatives to open the large, manifestly ripe abscess. Not a word could be said of an amputation, as the caries was usually more severe in the socket of the bone than on the ball of the femur. In threatened caries of the joint he considered ankylosis as the most favorable outcome; surgery could not reach it, but only medical treatment, which required for the strengthening of the constitution, first of all, nourishing diet, fresh air, cinchona and opium. It appeared to him worthy of note that caries of the joints of the upper extremities was, as a rule, more easily cured and less frequently fatal than that of the lower extremities, because the lower limbs could only with difficulty be kept in continuous nnd absolute repose, and the patient must do without movement and fresh air. *Gonorrheal* inflammation of the joints was described in detail by Musgrave in 1723.

Chronic inflammations of the joints were placed in one group and given the name fungus articuli, white swelling or the designation applied by Wiseman, tumor albus (white swelling 1734). The work of B. Bell ("A Treatise on the Theory and Management of Ulcers with a Dissertation on White Swellings of the Joints," 1778) was most accurate, but Brambilla's treatise (1787) was without scientific value. Bell distinguished rheumatic from scrofulous white swelling, and in brief, in the following manner: In rheumatic white swelling the ligaments of the joints first suffer and swell, and later the bones, which sometimes become carious; the pain extends immediately over the entire joint; the swelling, also at first considerable, is located in the soft parts; usually in young people arising after injuries, which form is curable. In scrofulous white swelling the bones suffer first. Their joints swell, and become spongy and the cartilage disorganized; later the soft parts are affected. (Dörner of Tübingen endeavored to prove, by experiments in 1798, that cartilages of the joints could not become inflamed.) The pain is at first limited to a single small place; the swelling, at first slight, evidently proceeds from the bones. This form, arising spontaneously in dyscrasic people, is almost always incurable. In rheumatic white swelling Bell recommended cupping, blisters and mercury salve (Pott and Ford the fonticulus, and Kirkland cold water), and for the stiffness remaining, the rubbing with olive oil; in threatening caries nothing but amputation will suffice. He knew of no remedy for scrofulous white swelling and even regarded amputation as useless. If the dispersion of the suppuration of the joint failed, Kirkland evacuated the fluids through a very small opening, endeavoring to avoid the admission of sir and to accomplish a prima intentio. Instead of amputating he applied resection according to Park's suggestion. Douches of warm water, for stiffness, were first recommended in France (le Dran, Bell and Aiken), and of water of lead (Goulard), also of chalybeate water and decoctions of finely divided herbs which were allowed to fall from a height of four stories (Thedens). Besides douches of fluids, hot fine or coarse sand or small stones were similarly used (Pouteau in sciatica). The all-curing electricity was not allowed to be lacking in the overcoming of stiffness of the joints. (In the eightieth year of the century Maudayt of Paris and Birch of London were specialists in this branch, and their widely extended activity resulted in the use of electricity in all possible ailments, rheumatism, paralysis, persistent swelling after fractures, luxations, sprains, amaurosis, ophthalmology, old ulcers, chilblains, deafness, toothache, dropsy, epilepsy, inspissation of milk, suppression of menstruation, pollution, etc.)

Heister distinguished *dropsy* of the joint from white swelling, only by the fact that in the former "the fluids collect in the joint itself, in the latter they stagnate

outside of the joint." Hydrarthrus of the knee gave the surgeons slight concern; if they did not succeed in dispersing it, then, according to the example of Würtz and Purmann, an incision was made and the water let out; the operation was opposed only in case of old and large swellings and delicate patients. In order to prevent a new gathering Purmann had a vulnerary water injected into the cavity of the joint, which Heister recommended, or according to Würtz a tight bandage was adjusted around the knee. Even the intelligent O. Acrel, after an unsuccessful attempt to scatter the fluids, made two crescent-shaped incisions on the knee, and had the good fortune to cure his patient without any ill consequences. As one of the first to raise a warning voice, Richter, well knowing that inflammation and fatal suppuration might follow a large incision, permitted only a puncture by means of a trocar under the displaced skin. B. Bell went one step farther. He discarded the operation entirely, even if the other means, as rubbing, douches, plasters and envelopment did not allay the swelling; the consequences of the operation seemed to him much more serious than the pain of the patient if the swelling were left to itself. Mohrenheim gave "strengthening injections" when the effusion of water continued after the incision, and Gay, a surgeon at the Cape, first made alcoholic injections through an extended trocar puncture (1789). In case of the gathering of blood or pus, Bell also ordered an evacuation as soon as possible, by means of the trocar; Theden once lost a patient with hemarthrus in the knee, when, after opening, repeated hemorrhages, as much as seven pounds in one day, ensued. Our acquaintance with *loose bodies in the joints* we owe to A. Paré who, in 1558, cut "une pierre de la grosseur d'une amande" out of a knee, with success; seven years afterward the German physician Wagner found such a one in the joint of an ox. Views differed greatly as to the manner of their origin; they were regarded as a precipitate from the synovia, analogous to bladder-stone (Paré), as pieces separated from the cartilages of the joint or from the bone (Monro, Mohrenheim and Löffler), loosened formations of cartilage (Ford, and similarly Desault), scirrhous synovial glands (Theden), transformations of a part of the synovial membrane into cartilage (Bichat). J. Hunter considered them as originally extravasated blood which had become organized, assumed the nature of the part with which it was connected and, by rubbing, had gradually become separated from it. This view, later renounced, was supported anew by Velpeau. The pieces of the loose bodies varied much in length (Theden, three inches), and also in number; for example, E. Home had seen, in a pseudo-arthrosis, thirty or forty loose bodies of a cartilaginous or harder character in the newly formed capsular cavity. Surgeons were not united as to the indications for excision, of which method we have spoken in the previous chapter. B. Bell would only cut out the movable cartilage when it was entirely loose, movable and the pain very severe; when immovable he either did not operate at all, or if the pain was unbearable he preferred amputation, because in such a case the inflammation following excision is of unusual severity. On the contrary, Desault did not at all avoid this operation so long feared by practitioners. When previously the surgical axiom was accepted, which considered wounds in the joints as, if not fatal, then extraordinarily dangerous on account of the admission of air, he showed that under methodic treatment they were rarely accompanied by serious complications and therefore the operation for bodies in the joints, methodically performed, could have no injurious consequences. In order to avoid the operation Gooch endeavored to hold the movable cartilage firm by a bandage in a position that was not painful. A case described by C. C. von Siebold under the diagnosis "lameness" ("Chir. Tageb. Beob.," xiv, s. 35) gave weight to the *joint neuralgia*, first described by Brodie (1836); an unmarried person, of 30 years, who had suffered from suppression of her menses, had uninterruptedly, day and night, for six months, the severest pain in her right hip and could no longer stand. Salves and plasters were without avail until a copious bleeding, with purgatives, restored her so far that she could walk without crutches, but limped badly. Siebold assigned as the immediate cause of the difficulty a congestion of blood at the hip joint, upon which an obstruction of the smallest blood vessels in the synovial glands and ligaments, and a deficiency of synovia followed.

(To be continued.)

SOCIETY PROCEEDINGS.

Mississippi Valley Medical Association.

The twenty-third annual meeting of the Mississippi Valley Medical Association held in Louisville, Ky., October 5 to 8, was a signal success in every respect and will pass into history as the banner meeting. The Committee of Arrangements, with H. H. GRANT, M.D., as chairman, had the affairs of the reception well in hand before the meeting. There were so many papers offered on the program that it became necessary to hold the meetings in two sections, a medical and surgical. The general sessions and the medical section were held in Liederkranz Hall and the surgical section in the Scottish Rite Hall immediately next door. The Committee felt much chagrined that the acoustic properties of the Liederkranz Hall proved so poor when only partly filled, as was the case when the general meeting divided for section work. This proved quite annoying, at times necessitating poor ventilation when the windows were closed to shut out the outside noise.

A feature of the meeting was the exhibit hall, in the basement of Liederkranz Hall. Here, attractively arranged, were some twenty-six exhibits representing all branches of mechanical, instrumental and therapeutic appliances, the hall being crowded all the time.

The general sessions and the medical section meetings were presided over by THOMAS HUNT STUCKY, M.D., of Louisville, president, and the meetings of the surgical section by the first vice-president, C. A. WHEATON, M.D., of St. Paul, Minn.

On the morning of the first day, after the preliminary exercises, Dr. Stucky read his presidential address, which dealt with a brief history and mention of the physicians that the Mississippi Valley had given to the world and who had become famous. He paid a feeling tribute to the late Edward R. Palmer, who met such a sad and untimely death.

At the first meeting a revised constitution of the Association was read, it coming as a recommendation from the Executive Committee, which had met the evening before. The changes were radical in some respects, providing for the perpetuation of the Judicial Council, making it obligatory to pay all dues and providing for the dropping of members for the non-payment of dues for two years; providing for the payment of a small salary to the secretary and for the publication of a volume of "Transactions." These recommendations were adopted on the last day.

Governor BRADLEY made the address of welcome on behalf of the State and city, and WM. BAILEY, M.D., on behalf of the physicians of Louisville. It was at this time that the rumor became current that the State of Indiana had declared quarantine against Kentucky because of the fact that Kentucky had opened her gates to the refugees from the infected yellow fever district. This called forth strong denunciatory telegrams

from Governor Bradley to the Governor of Indiana and also from a committee from the Association composed of Drs. I. N. Love and C. A. Wheaton. This message was in the form of a resolution offered the Association, and was seconded by W. N. Wishard, M.D., of Indianapolis and A. P. Buchman, M.D., of Fort Wayne, Ind. The next morning C. W. Brayton, M.D., of Indianapolis offered a resolution recalling what passed the day before, as it had since been ascertained that there was needless apprehension and that no quarantine had been declared. This was referred to the Executive Committee, which made some changes therein and, as reported, it was passed and sent to the Governor of Indiana.

Dr. JOHN V. SHOEMAKER's address was entitled, "Progress and Problems of Medicine."

He first took up the subject of organo- and sero-therapy, and pointed out the extent of progress of science in furnishing effective serums and antitoxins for the cure of infectious disorders. Passing briefly over the yellow fever organism and the use of the Roentgen rays, Dr. Shoemaker took up the subject of cancers, the cause and treatment of which he stated were the most difficult problems of medicine. The only recourses to effect a cure, he stated, are the knife, caustics and electricity. None of these in the minds of the learned physician had satisfactorily solved the problem. The urgent desideratum was a method of arresting a malignant growth and causing its retrogression or expulsion. Among the methods employed the speaker mentioned the application of sero-therapy, the use of erysipelas toxins, methyl violet and methylene blue. Celandin, the remedy brought forward by Denissenko, had proved inefficient. In speaking of malaria, Dr. Shoemaker said that the life history of the parasite is not known outside of the human organism. He believed that the mosquito had much to do with its transmission. He called attention to the fact that chronic malaria was becoming a potent agency in the genesis of various affections, producing anemia, cardiac excitability, neuralgia, neuroses and organic affections of different kinds. Concluding his paper, Dr. Shoemaker said: "Eleven years ago, in an English city and at a meeting of English physicians, I listened with shame and indignation to an American belittling his country. Various alleged shortcomings were exposed, and the evil influence of malaria upon intellectual development was depicted. A map, shaded to represent the prevalence and fatality of malaria, was exhibited, and the astounding statement was made that malarial intoxication was incompatible with scientific acquirements. I looked upon the map, and behold! the greater part of the United States was under a portentious shadow. In the north and east and in the northwest the gloom was lightened in a comparatively small area, but the great Mississippi Valley was shaded in the darkest hue. Almost the whole south, in fact, was included in the same condemnation, for the dark shadow ran down along the Atlantic seaboard. It is true that within the malarial districts McDowell, Sims, Gross and Campbell lived and labored, but these men, only four in number, were exceptions and exceptions proved the rule." Controverting this statement Dr. Shoemaker mentioned among the men who were reared in the malarial belt and who became conspicuous in the higher departments of human activity, Henry Clay, Andrew Jackson, Thomas H. Benton, Prof. Samuel D. Gross, "The Nestor of American Surgery," John C. Calhoun, Abraham Lincoln, Jefferson Davis, James K. Polk, Garfield, Hayes and McKinley, Gen. William Harrison, Daniel Drake, John T. Hodgen, Robert Battey, Crawford K. Long, and Samuel M. Memiss.

The address of JOHN B. MURPHY, M.D., on surgery, entitled "Ileus," was a masterly effort and was listened to with the closest attention by a large audience.

A noticeable feature of the meeting was the small number of papers that were read by title and the fact that during the meeting every paper was called for in both sections, which shows how well the scientific part of the meeting was cared for.

There were no night sessions of the Association, the evenings being taken up by informal private entertainments on the evening of the first day and a reception on the second evening, with a "smoker" on the evening of the third day. At the reception and the smoker the services of Col. Wm. Visscher of Chicago were enlisted for the entertainment of the guests, a collation being served at both.

When the report of the nominating committee was read some discussion took place as to the place of meeting recommended by the committee, viz., Nashville, which was opposed by X. C. Scott, M.D., on the grounds of exorbitant charges on the part of the hotels in the city during the meeting of the AMERICAN MEDICAL ASSOCIATION there some years ago. After some discussion the report of the committee was adopted by a vote of the Association, and the time of meeting placed the second Tuesday in October, 1898. The officers elected were as follows: President, John Young Brown, M.D., St. Louis; first vice-president, A. P. Buchman, M.D., Fort Wayne, Ind.; second vice-president, A. J. Ochsner, M.D., Chicago; secretary, Henry E. Tuley, M.D., Louisville; treasurer, C. A. Wheaton, M.D., St. Paul, Minn.

The official button given each member who registered was a sterling silver one containing the words, "Mississippi Valley Medical Association, Louisville, Ky., 1897," and in the center a splendid reproduction of the steel engraving of Ephraim McDowell, with the name beneath. The effect of the oxidized background and the bright lettering was very effective, and the button was cherished by all as a valuable souvenir of a most enjoyable meeting.

New York State Medical Association.

The New York State Medical Association held its fourteenth annual meeting at the Mott Memorial Hall, New York City, October 12, 13 and 14. There were also two night sessions and one of the afternoons was given entirely to the discussion of hospital and dispensary abuses. To this last the following contributed either by person or debate: Drs. F. E. Stewart, F. H. Wiggin, Wickes Washburn, J. E. Janvrin, Thomas H. Manley, J. R. McGregor, Nelson L. North, Thomas J. Hillis and John Shrady. A notable incident was the appearance of Mr. J. Harsen Rhoades, long identified with public charities in most of their forms. The burthen of his defense was that physicians themselves were the chief offenders, and that too with a disposition to shift the responsibilities upon others. Certainly there was every desire on his part to redress these grievances, but how without a delegated power. A breezy paper on "Medical Expert Testimony," by Homer O. Jewett, M.D., of Cortland County, attracted much notice in the light of certain recent procedures, and it is hoped will prove a factor in reform. The program was long, varied and in the main, as is usual with this Association, carried out to the letter. The presidential address by Charles Phelps, M.D., was suggestive and worthy of appearing in print long before the issue of the elegant although somewhat tardy "Transactions." Drs. E. D. Ferguson and Joseph D. Bryant contributed to the growing literature of appendicitis and also F. S. Dennis, M.D., a well considered paper on "Tetanus." The third day, the morning, with the exception of a paper on "Pyothorax in Children," by Douglas Ayres, M.D., of Montgomery County, was given up to gynecology and obstetrics, in the discussion of which the names of the following appeared: Drs. Charles H. Glidden, William H. Robb, Martin Cauana, George T. Harrison, C. C. Frederick and Ely Van de Warker. Among the topics of interest we can not omit to mention, "Acute catarrh of the middle ear as a sequel of la grippe" by Samuel Wesley Smith, M.D.; "Studies on typhoid," by Henry C. Boswell, M.D.; "Further notes upon the operative treatment for infantile paralysis," by S. E. Milliken, M.D.; "Stricture of the rectum," by W. S. McLaren, M.D., of Litchfield, Conn.; "A case of otitic brain abscess from chronic otorrhea; opening of mastoid and skull; recovery," by Frank S. Milbury, M.D.; "The surgery of tuberculosis of the peritoneum," by Parker Syms, M.D.; and "Traumatic paralysis of the upper extremities," by John F. Erdmann, M.D.; "A new intra-ocular iris scissors," by H. W. Wandless, M.D., of Dallas, Texas; "General considerations concerning auto-intoxication," by H. A. Haubold, M.D.; "Symptoms noted during the interparoxysmal stage of hysteria," by William D. Granger, M.D.; "A study of alcohol, tobacco, tea and coffee and their effects in nervous disorders," by Charles E. Lockwood, M.D.; "Massage as an occupation for the blind," by Arthur Y. Bennett, M.D.; "The effects of poisoning," by Morris W. Townsend, M.D.; "Tuberculosis of the tonsil," by Seymour Oppenheimer, M.D.; "A case of elephantiasis of the vulva, with specimen," by William P. Finder, Jr., M.D.; "The new epoch in the study of neural pathology," by W. A. Van Gieson, M.D.; "The conservative surgical treatment of fibromyoma," by E. E. Montgomery, M.D., of Philadelphia; "Some remarks on ovarian surgery," by A. Palmer Dudley, M.D. Such a program, even without the usual annual summary of materia medica, pharmacy and therapeutics by E. H. Squibbs, M.D., could not but satisfy the most fastidious.

The matter regarding the pledge of the Association to subscribe $2,000 toward the erection of a statue in Washington to

Benjamin Rush, the "surgeon of the Revolution," was taken up. The treasurer, Dr. E. D. Ferguson of Troy, stated that there was a surplus of $3,500 in the treasury, for which there was no immediate use, and favored an appropriation of the $2,000 instead of subscription by the members. After some discussion it was unanimously voted to follow this course, and the treasurer was instructed to send that amount to the committee promoting the monument. The following were elected officers for the ensuing year by acclamation: President, Douglas Ayres of Fort Plain; vice-presidents, second district, C. E. Fritts of Hudson; third district, H. W. Carpenter of Oneida; fourth district, C. C. Frederick of Buffalo; fifth district, N. W. Leighton of Brooklyn; members of council—first district, W. H. Robb of Amsterdam; second district, E. M. Lyon of Platts burg; third district, W. L. Ayer of Owego; fourth district, Z. J. Lusk of Warsaw; fifth district, J. G. Truax of New York. A committee composed of F. H. Wiggins, S. B. W. McLeod, Parker Syms, A. H. Hubbell and E. D. Ferguson, was appointed to act in co-operation with other societies in an effort to bring about the passage of a law looking toward the correction of hospital and dispensary abuse.

SELECTIONS.

An "Oxygen Home" for the Treatment of Wounds.—The *Sanitary Record* says: Some weeks since we announced that some remarkable cures had been effected under what is termed "oxygen treatment," and that to extend the scope of the experiments a home was to be opened in London to test the system more fully. . . . An "Oxygen Home" was opened at No. 2 Fitzroy Square by the Princess Louise, Marchioness of Lorne. We may remind our readers that the system owes its origin to Dr. George Stoker, who, when serving in the Zulu War, observed that the natives always carried their wounded as far up a mountain side as possible, and that the altitude of this *al fresco* hospital appeared to have a wonderful effect in bringing about rapid recoveries. This led him, on his return to England, to undertake experiments in treating wounds with oxygen gas, and these have been singularly successful. Princess Louise witnessed the treatment in operation, as on most of the beds there was a specially constructed box, with glass sides, in which the wounded limb was kept in an atmosphere highly charged with oxygen. Thus the progress of a wound can be closely watched without the irritation of winding and unwinding bandages. Briefly, the treatment is as follows: "The oxygen acts in one or more of the following ways: By diminution of irritation, as any dressing applied to an open sore causes more irritation than a mixture of oxygen and pure air, while at the same time the oxygen stimulates, and not improbably oxidizes the toxins produced by micro-organisms in the surface of the ulcer. These and other points are under investigation, but enough is already known practically in favor of the oxygen treatment to fully establish its value."

The Sound Therapeutics of the Good Samaritan.—In a recent debate in the British Parliament, on the Græco-Turkish imbroglio the action of Greece in coming to the rescue of her Cretan compatriots was likened by the leader of the opposition to that of the good Samaritan who relieved the wounded victim of highway robbery after the priest and Levite, typifying the concert of Europe, had passed by unmindful of his sufferings. With the political application of the parable we have nothing to do any more than with the retort of the leader of the house that the good Samaritan would not have been admired for eighteen centuries if as a result of his intervention he had added largely to his personal estate. Our interest in the parable lies in its medico-legal aspect, in the treatment to which the wounded man was subjected and in the light it throws on first century practice. The parable, we need hardly remind our readers, comes to us on the authority of what M. Renan calls "le plus beau qu'il y ait," the most beautiful book in all literature, the work, we may add, of a physician whose familiarity with Hippocrates has been proved by Hobart and Plumptre, and whose practice seems to have lain, at least for one memorable period, in the mercantile marine of the Mediterranean. Till recently the only version of the parable accessible to English readers represented this capable practitioner as reporting the good Samaritan to have bandaged the victim's wounds, incised, punctured, or lacerated, and then to have poured into them oil and wine. That mistranslation continued to puzzle generations of the devout till the "revised version" put matters right by substituting "pouring on" for "pouring in," the authorized rendering having been adopted from a misinterpretation of the vulgate, which gives "infundens" as the equivalent of St. Luke's ἐπιχέων, though "infundo" means to "pour upon" as well as to "pour into." The good Samaritan's therapeutics are thus vindicated as conforming to the recognized practice of the time, whether Greek or Jewish. The bandage having been adjusted, it was saturated with a mixture of oil and wine, an emollient and a stimulant, presumably to keep the cloth from stiffening while rousing the reparative or healing process. It was the practice employed in circumcision, as we read in the rule: "If there is no mixed oil and wine ready, each may be added separately." Galen, writing about 130 years subsequently to St. Luke, describes a paste in which oil and wine are the principle ingredients, to be applied to wounds. The elder Pliny, whose "Historia Naturalis" was nearly contemporary with St. Luke's Gospel, refers to the same practice. The good Samaritan's therapeutics, as reported by St. Luke, were indeed *secundum artem*; and if they have caused any difficulty to the non classic reader, that has been removed by the revisionist substitution of "pouring on" for the meaningless "pouring in."—*Lancet.*

Practical Points in the Use of Milk Modification.—The *Cleveland Journal of Medicine* for August gives an account of a discussion on the above subject, in the course of which Dr. T. M. Rotch of Boston explained certain points that are not ordinarily brought forward in formal papers. In substance the speaker's remarks were as follows:

It is true that harm may be done by an inexact combination of different constituents of modified milk, but then we must take into consideration that in everything in medicine and surgery there is danger in the hands of those who do not do it properly. Physicians must learn to use the laboratory. I have seen bad results from a physician not prescribing correctly. It is not as dangerous, however, as using artificial foods and not knowing what you are using. I believe in feeding with human milk, but you have to learn how to use it, and when you can not get it you must learn how to use cow's milk.

I think in Boston they sell eight tubes, with four or eight ounces, for 50 cents. It is not a cheap food. A great deal of harm has been done by the physicians of New York, who say we must have cheap food for the people. I think we ought to give the best food to infants. As in everything else, you can not get a good thing cheap; you have to pay for it. As it is developed it will be made more cheaply. I have encouraged them to raise their price rather than lower it. Philanthropists in Boston, especially Mr. N. S. Kaetlett, have been getting up funds to buy modified milk for poor babies. Now the poor babies are fed just as well as the rich ones. I think physicians and surgeons ought to find and prescribe that which is best for the human race. The argument that the laity will adhere to their prepossessions in favor of the artificial food has been brought up over and over again by physicians. It is not the people's fault but the physicians'. I think we should work in the best way, no matter how we are criticised. There will for a long time to come be cities and towns where a laboratory can not be sustained.

The first step is to recognize the principle. Then carry out the principle as well as you can. The home modification of milk is fully recognized in my book. I have given precise rules how to modify milk. Supposing you are in the country with a baby with weak digestion. See that the cow is clean and milked by some one careful to see that the baby gets the last part of the milking freest from organisms. With a Babcock milk tester you can tell what is the percentage of fat in a given sample. My great-grandfather was professor of materia medica in the University of Pennsylvania and I have the pestle and mortar with which he pounded his drugs. He, for lack of an

apothecary shop, modified his drugs at home. Up to the present time, owing to the lack of a milk laboratory, we have modified the infant's food at home. Now there is no longer a necessity for home modification either in drugs or milk.

There is probably some difference between the proteids of cows' milk and human milk. "Caseinogen" is a better word than "casein," which is being gradually dropped. I think that there have been a great many erroneous views held in regard to this difference. Nowhere in the world are they working on wrong principles so much as in Germany. We know that the coagulable parts of the proteids in cow's milk is greater than in human milk, therefore, other things being equal, we should prescribe a rather lower percentage in human than in cow's milk. I do not think the Germans have sufficiently proved to us any other difference. I think they are very theoretic in their treatment of this question. They have not adopted our methods. They are usually in the foremost ranks of investigators, but I do not think they are in this. I have been much interested in observing the curds in human milk and have seen them as large and heavy as in cow's milk, and on examination have found that in these cases the proteids were as high as in cow's milk. The reason you note a heavier curd oftener in cow's milk is because you do not usually get so high a proteid in human milk. In regard to the substitution of sugar for the proteids, I think it is very theoretic and do not think it is going to be supported by scientists throughout the world. I do not believe the sugar is going to be used in place of the proteids. The partial digestion I think is unnecessary, and the less tampering with the proteids before they enter the stomach the better. The infant's stomach should be taught to digest proteids and not to have them digested for it. Much work of this kind has been done in Germany, but I look upon it with profound skepticism. I do not think they are right. They are always trying to make out differences, but they never have done it. I do not think the Germans fully appreciate what we are doing in this country. They have gone so far ahead of us in some branches that it is difficult for them to think that we do anything of value here, while in fact they are far behind the times in the matter of feeding.

Tests for Defective Vision in School Children.—Instances of students who, through myopia or other ocular diseases, are unable to see reasonable distances, and who, by glasses or other treatment, find such obstacles removed; or of others, who, through hypermetropia or astigmatism, find themselves disinclined to study, owing to an overtaxed muscle of accommodation with consequent asthenopia or eye-tire, headache, etc., and who by suitably adjusted glasses are enabled to study with pleasure and comfort, are of sufficient frequency to have deeply impressed every individual engaged in educational work.

Between two and three years ago I submitted to the Minnesota Academy of Medicine a paper entitled "Refraction in Schools," proposing a procedure for the easy detection of most ocular diseases by principals, through which students might be placed upon a path leading toward relief, that impressed the Academy so favorably as to induce it to forward to the Minneapolis Board of Education a petition for its formal adoption. The board at that time, for reasons probably satisfactory to itself, practically tabled the resolution. Last January, after the election of a new board, the method was adopted and the writer appointed as superintendent. Immediately active operations were begun, and in a short time 25,696 children had been examined by our school principals. One hundred dollars was allowed for expenses, which has more than covered the expenditures, as only some test-types and printed matter are necessary. A plain lecture was delivered to the principals descriptive of ocular anatomy, physiology and refraction, with its errors, including myopia, hypermetropia and astigmatism. This was supplemented by a clinic or practical demonstration of the method on some fifty pupils furnished by Superintendent Jordan, during which the writer first made his test, distributed cards and filled in the statistical papers himself, and then requested many of the principals to do the same under his instruction. Test cards and printed matter were then distributed to the principals and they were requested to make the tests as rapidly as was consistent with their other work. The examination should not be conducted in the presence of other scholars, as familiarity with the letters leads to correct responses. It should be ascertained if the child habitually suffers from red and inflamed eyes or lids, after which the visual tests should be conducted. The Snellen test card should be hung upon the wall in a good light, uncovered by glistening glass and on a level with the pupil's head. The letters are of such accurate proportions as to be seen by a natural eye at certain fixed distances. The pupil should be given credit for the smallest line of which he reads a majority of the letters and result inscribed as 20, 30, 70, 200, etc., in the appropriate line of the statistical blank. . . . After noting the smallest line read by each eye, it should be ascertained if the pupil really habitually suffers from tired eyes or headache after study, care being taken that such troubles are not imaginary. . . . If inflamed eyes are not habitual, the pupil reads a majority of the letters in the 20-foot line with each eye and does not frequently experience eye tire and headache after study, the examination may be considered satisfactory; but if the reverse of this develops, a card of warning should be sent to the parent, urging that an "eye doctor" be consulted at his office or dispensary. The word "eye doctor" should be used, as many people do not discriminate between the words oculist and optician. The warning cards may be heeded or not, as the parent elects; it is not obligatory and imposes no hardship. The influence of the principal may, of course, be exerted in the proper direction, but such influence must obviously not be directed in favor of any particular oculist or dispensary, but should be used against the consulting of opticians at department stores or elsewhere. Children already wearing distance glasses should be tested with such glasses on the face, while those wearing glasses for close work should be questioned as to the existence of asthenopia when glasses are worn; by so doing much opposition from parents and attending oculists will be avoided. . . . Only such children as are deemed defective require statistical tabulation, the others are not further molested until the next annual examination, which should occur at the beginning of each school year. Experience has taught that it is unprofitable to examine first grade children. The report of our first annual examination shows that 25,696 children have been tested, of whom 8,166, or 32 per cent., were deemed defective. Among these, 6,451 eyes were found possessing a vision of 20-30, or a little worse than normal; 2,256 eyes had a vision of 20-40, 1,214 a vision of 20-50, 1,130 a vision of 20-70, 745 a vision of 20-100, 447 a vision of 20-200 and 43 eyes were practically blind; 4,472 children could not use their eyes to a reasonable extent without eye tire, headache, etc. The individual percentages of defectives in the different schools have ranged all the way from 11 to 67 per cent., the latter occurring in a conspicuously poorly lighted and insanitary building. What have been the practical results? These have been difficult, and in short, impossible to completely estimate, owing to many causes, of which a few will be enumerated. In the first place, such results can not be accurately compiled, for obvious reasons, unless all examinations are made and subsequently watched by a single oculist, either with or without assistants. Statistics compiled from numerous and unreliable sources are manifestly not entirely trustworthy. In the second place, many reports received by the writer from principals were very meagerly filled out. . . . The writer knows of many instances where good results followed treatment, but where such results were not duly chronicled. Then a very large proportion of defectives are delaying the consulting of an oculist from various causes—among which may be enumerated heedlessness, carelessness, incredulity, pride coupled with financial distress, fear of being advised to wear glasses, the near approach of a long vacation, during which time such matters may be adjusted, etc. Many children who are debarred from seeking proper advice from these and other causes, will naturally soon be enumerated among those who are deemed defective, sought counsel and received benefit. But notwithstanding these obstructions to progress, the annual reports recently studied, together with subsequent conferences with principals, show unmistakably that in the neighborhood of two thousand children have been signally benefited by the results of the preliminary tests. Many near-sighted children unable to see blackboards, charts, etc., and debarred from comprehensively observing the world and learning its lessons, have by the aid of properly adjusted glasses been placed upon an equality with their comrades. Many children unable to study without pain and fatigue, consequent upon hypermetropia or astigmatism, have by a similar remedy been relieved of their infirmity and enabled to assume high rank as scholars. Other children have been emancipated from the mortification incident to the possession of crossed eyes by an operation, while others have been placed on the road to good vision by operative interference upon congenital cataracts. One of the chief obstacles to

satisfactory results has been the frequent consulting of opticians instead of oculists. The eye is not a merely mechanical machine, which, when "out of order," simply requires for its correction a pair of glasses. It is one of the most delicate and complex organs of the body, liable to the diseases of other living structures, and extremely sensitive to improper treatment, including the adjusting of glasses, which, if improperly performed, often leads to the direst consequences. Pathologic ocular conditions, including refractive errors, can not be properly diagnosed and treated without a good medical education, supplemented by special ocular instruction, fair judgment and experience. It is, therefore, almost an insult to intelligence to urge that even the best opticians are incapable of passing judgment upon diseased ocular conditions or of properly correcting refractive errors, although they may frequently happen to give good satisfaction in recommending a pair of glasses. The truth is that in undertaking such work they are practicing medicine and should be legally restricted in their trade to selling, dispensing and manufacturing glasses, a principle which has been recently emphasized by the Ohio legislature in an act restraining opticians from prescribing glasses, under improper circumstances.—Abstract of paper by Frank Allport, *Educational Review*, Sept. 1, 1897.

PRACTICAL NOTES.

Warning Against the Use of Boric Acid in Otitis Media Purulenta.—*Memorabilien* mentions that when the secretion is scanty, the powder has a tendency to form a crust with it, and close the opening.

Urine Tests in Laryngology.—Mulford mentions several cases of ear or throat trouble in which the treatment was indicated by testing the urine. The local disturbance vanished with the general treatment instituted.

Bactericidal Power of Iodoform Increased.—Thomalla of Berlin has added 5 per cent. polymerized formic aldehyde to iodoform and reports that suppurations dry up and wounds heal much more rapidly and thoroughly than with the iodoform alone.—*Semaine Méd.*, July 28.

Delirium Tremens Paraldehydicum.—Reinhold adds another to the five cases on record of acute delirium tremens produced by excessive use of paraldehyd (in his case 60 grams had been taken daily for some time to cure insomnia). The symptoms abated and absolute recovery followed in sixteen days. All the other cases also recovered completely.—*Wien. klin. Woch.*, August 5.

Cure of Vomiting in Pregnancy by Prolonged Palpation.—J. Geoffroy states in the *Gaz. Méd. de Liége*, of Sept. 2, that the vomiting is caused by reflex contraction of parts of the alimentary canal, pylorus, duodenum, secondary to contraction and hyperesthesia of the ilio-pelvic angle of the colon. Prolonged palpation reveals the existence of the contraction at this spot and is also the cure for it, rapid and certain, in one to three brief seances. He adds several convincing observations.

Nicoladoni's Suture in Resectio Recti.—The proximal stump remaining after the resection is drawn out through the anus without force and sutured to a ring made of wire wound with gauze 3 to 4 cm. in diameter. The greater part of the mucosa is removed from the distal end, and a few internal sutures then suffice to fasten the invaginated ends together. The ring allows irrigation to keep the rectum clean from fecal matters. He gives saline laxatives, never opium. Two cases thus sutured have demonstrated the advantages of the ring.—Prof. C. Nicoladoni in *Cbl. f. Chir.*, September 4.

Treatment of Chronic Constipation with Creosote.—It is announced that creosote not only breaks up the most inveterate case of constipation, but improves the general health. It acts probably, by neutralizing some toxin that has been paralyzing the nerves of the intestinal tube. Its beneficial action was discovered by V. de Holstein, who has contributed an article to the *Semaine Méd.*, on the subject (September 1). He administers seven to eight drops twice a day, after the two principal meals, in a glass of milk, beer, or water, with or without wine. He uses pure beech creosote, and commences with one drop, increasing one drop a day, until the requisite dose is determined.

A New Phenomenon observed in Facial Peripheral Paralysis, is reported by Bordier and Frenkel in the *Semaine Médicale* of September 8. The subject affected with severe peripheral facial paralysis is unable to close his eyes when requested, without turning the eyeball of the side involved upward and slightly outward. This sign indicates the gravity of the prognosis, and the progress toward recovery as it gradually disappears.

Sanoform.—P. Sternberg of Berlin, describes in the *Ther. Mon.*, July, his favorable experience with sanoform. He has used it in ninety cases, thirty-seven of them fresh wounds. The powder was applied copiously after cleaning the wound with an occlusive bandage. In two to four days the bandage was changed, when the wound was found healed in most of the cases. If necessary a second dressing was made, under which the wound healed smooth. In twenty-eight cases there was suppuration, abscesses, panaritium, etc., which were first lanced and curetted. When the bandage was changed they were found almost completely dry, and at the second change of the bandage most of them were quite healed. Fourteen cases of fissures and rhagades were treated with a 10 per cent. sanoform-lanolin salve and healed in the shortest time. Six cases were tamponed with sanoform gauze, which is sterilizable.—*Ther. Woch.*, August 1.

Acute Purulent Arthritis due to Pneumococci.—Fournier and Courmont (*Revue de Médecine*, September 10, p. 681), maintain that in addition to subacute and chronic forms of arthritis due to pneumococci, there occurs also an acute phlegmonous form, of which they describe an illustrative case. From the anatomo-pathologic point of view, three degrees of arthritis due to pneumococci may be described: 1, the mild form without macroscopic lesion; 2, the form attended with simple hydrarthrosis; 3, the ordinary purulent form; 4, the form presenting osteo-arthritis with cartilaginous and osseous lesions, which occurs rather more frequently than is generally believed. In the course of arthritis due to pneumococci, death, which occurs rather frequently, is due most often to secondary generalization of the micro-organism to other serous membranes (pleura, pericardium, meninges), and rarely to the primary infection. This generalization may be attributed to impaired resistance of the soil, and to maintained virulence of the micro-organism, even after its passage through the articulation. This virulence, however, seems in certain cases to be attenuated in proportion to the multiplicity of the lesions.

Inflammatory Conditions of the Uterus, Adnexa and Pelvic Peritoneum with Intra-uterine Irrigations.—From Tomsk comes the announcement by Prof. J. N. Grammatikati, that all the above conditions are healed with the best results, even the most obstinate endometritis and gonorrheal affections, with daily irrigations for an average of forty days, with one gram of the solution: Alumnol, 2.50; tinctura iodi and alcohol absolut. aa 25.0, injected with a Braun syringe. The surrounding parts are first disinfected, the portio opened with a speculum and parts held with ball forceps; Hegar dilator used if necessary. Two grams of the solution are used in acute inflammatory conditions with exudation. The menses are arrested by fifteen to twenty irrigations and this temporary climacteric which lasts two or three months is an important factor in the cure. Neoplasms frequently subside completely with this treatment, and where a pyosalpinx still requires operating, the indications are much more accurately determined after the remarkable improvement secured by the irrigations. Many chronic cases

were so much improved that an operation ceased to be necessary, and in grave gonorrheal affections the ability to conceive returned. No inconveniences were observed from this treatment in the 3,000 irrigations made in his clinic during the last three years. Transient pain in a few cases was relieved at once by repose or a morphin suppository, 0.01.—*Therapeutische Wochenschrift*, August 22.

Oil of Wintergreen as an External Application in Rheumatism.—According to M. Lemoine, local applications of oil of wintergreen are valuable in rheumatic fever, acting more rapidly in relieving pain than salicylate of soda and being less liable to produce tinnitus or giddiness, which sometimes follows the use of the latter drug. He soaks a piece of lint in two or three drams of the essential oil, and applies it to the skin; the whole is then completely covered by oiled silk, which well overlaps the lint, and carefully bandaged so as to prevent external evaporation. The application is made over the painful spot if this is conveniently situated; if otherwise, the thigh or arm is chosen. In this case the oiled silk should be long enough to encircle the limb, and the absorption of the salicylate of methyl which forms some 40 per cent. of the oil produces almost as good result as if applied to the seat of the pain. This method of treatment answers very well also in some cases of sciatica and, according to M. Siredey, in chronic rheumatic affections, where it may be used for a considerable time without any ill effects, either local or general. Here it acts better when applied directly to the affected joints than when the dressing is placed round the shaft of the bone. The strong smell of the oil is the only inconvenience. The same application has proved useful in relieving the lightning pains in a case of locomotor ataxia. The use of oil of wintergreen as an external application in chronic and subacute rheumatism is not anything novel, though the particular method of its employment may perhaps be so. Mr. J. D. Staple, however, used it in the Stockport Infirmary several years ago as a liniment combined with an equal quantity of olive oil, and reported that in only two out of a hundred cases of chronic rheumatism did it fail to relieve the pain.—*Lancet*.

The Treatment of Surgical Tuberculosis with Koch's New Tuberculin.—Eve (*Lancet*, September 18, p. 705) reports eight cases of surgical tuberculosis subjected to treatment with Koch's new tuberculin (T. R.). Three cases of tuberculous disease of joints, without sinuses or evidence of softening of caseous material, were the only ones in which favorable results were observed. Two of these were examples of early tuberculosis of the elbow and hip respectively. Of these it was thought that the same results might have been anticipated from surgical rest, improved diet, etc. In the other, occurring in a patient with relapsing tuberculosis of the knee of four years' duration, it seemed probable that the remedy exercised a favorable influence. One case was an instance of tuberculous peritonitis with ascites, which was treated immediately by celiotomy. During the administration of the tuberculin there was no reaccumulation of the fluid, but the child continuously lost weight. It was necessary to give the tuberculin slowly and gradually, owing to the weakly condition of the child, and to avoid pyrexia. The remaining four cases were all examples of tuberculosis with sinuses. These, with one possible exception, were absolutely uninfluenced by the treatment. The sinuses did not heal and in three instances operation was ultimately required. The case of a child with tuberculous tenosynovitis of the dorsum of the hand seemed clearly to show that no immunity to tuberculosis was established by the treatment. The tuberculous material had become caseous and broken down, with sinus formation, but was not, in the ordinary acceptance of the term, septic. After the conclusion of the course of treatment with tuberculin, all of the tuberculous material was freely and carefully removed by operation, no bone disease being found. The wound healed by first intention, but two or three weeks later recrudescence occurred in the scar and subjacent tissues. The exceptional case referred to occurred in a patient with tuberculous epididymitis. A sinus that remained after the opening of an abscess healed during the administration of tuberculin. The personal impressions of the results of the new remedy are summed up as follows: Some slight, although no markedly favorable, influence may be exerted in cases of early tuberculosis of joints or in which no evidence of softening of caseous material exists, but the effect when caseous material has broken down, and especially if the disease has become septic, is negative.

Recovery after Stab-wound of the Heart and Pericardium.—Williams (*Medical Record*) has reported the case of a colored expressman, 24 years old, who, during an altercation, received a stab-wound through the fifth costal cartilage, injuring the internal mammary vessels and wounding the pericardium and heart. The wound was about an inch long, three-fourths of an inch to the left of the sternum, through and in the long axis of the fifth cartilage. With a probe only a superficial wound could be made out, but during the night there was such persistent hemorrhage, pain over the cardiac area, short, sharp, shrill cough and such pronounced symptoms of shock that a re-examination on the following morning showed that the knife had penetrated the fifth costal cartilage in its long axis at least far enough to wound the internal mammary artery and veins. When the knife had been withdrawn the elastic cartilage had closed behind it, preventing the introduction of the probe the night before. Operation was decided on and the original wound lengthened to the right as far as the middle of the sternum. A second incision about six inches in length was made from the center of the first and carried over the middle of the cartilage and fifth rib. The sternum, cartilage and about one inch of the fifth rib were exposed. The cartilage of the fifth rib was separated at its junction with the sternum and at a point two and a half inches from the sternum and one-fourth of an inch from its attachment to the rib. The inferior attachments of the incised piece were separated, leaving the superior ones in place. The incised piece was reflected upward, making an opening about two inches long and one and a half inches wide, bringing the internal mammary vessels into view. These vessels were ligated above and below with small catgut. This large opening permitted easy ligation and manipulation. To secure additional room an incision was made in the fifth intercostal space. The heart and lung being displaced backward, a small punctured wound of the heart about one-tenth of an inch in length and about half an inch to the right of the right coronary artery, between two of its lateral branches, was seen. The wound in the pericardium was about an inch and a quarter in length. There was no hemorrhage from the heart or the pericardium. The edges of the pericardium were held by long, smooth forceps and a continuous suture of fine catgut was introduced. Before the pericardial wound was closed it was irrigated with normal salt solution. Catgut was used in closing the intercostal and subcartilaginous wounds and silkworm gut in the cartilages and the skin. A few silkworm gut sutures were left long in the external wound, so as to permit of easy removal in case this should become necessary on account of infection or hemorrhage. A dry dressing was applied. The surgical progress of the case was not especially eventful. An effusion formed in left pleural cavity and in that of the pericardium. An incision in the seventh left intercostal space, two inches long parallel to the rib, gave exit to eighty ounces of bloody serum. There was no further complication and the patient left the hospital, well, seven and a half weeks after the reception of his injury. He was subsequently at work in the stock yards at Chicago two years later, and again three years later.

THE
Journal of the American Medical Association
PUBLISHED WEEKLY.

SUBSCRIPTION PRICE, INCLUDING POST AGE:

Per Annum, in Advance $5.00
Foreign Postage 1.75
Single Copies . . . . . 10 Cents.

In requesting change of address, give *old* as well as new location.
Subscriptions may begin at any time and be sent to

THE JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION,
No. 61 Market Street (Occidental Buildings), Chicago, Illinois.

MEMBERSHIP IN THE AMERICAN MEDICAL ASSOCIATION.

This is obtainable, at any time, by a member of any State or local Medical Society which is entitled to send delegates to the Association. All that is necessary is for the applicant to write to the Treasurer of the Association, Dr. Henry P. Newman, 100 Washington St., Chicago, Ill., sending him a certificate or statement that the applicant is in good standing in his own Society, signed by the President and Secretary of said Society. Attendance as a delegate at an annual meeting of the Association is not necessary to obtain membership.

On receipt of the subscription the weekly JOURNAL of the Association will be forwarded regularly.

Gentlemen already members of the Association should send their annual subscription to the Treasurer, or direct to the JOURNAL office.

All communications and manuscript of whatever character, intended for publication in the JOURNAL, should be addressed to the *Editor*, and all communications relative to the business of the JOURNAL, proof sheets returned, or in regard to subscriptions, should be addressed to THE JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, 61 Market Street (Occidental Buildings), Chicago.

Original communications are only received with the understanding that they are exclusively contributed to this JOURNAL.

SATURDAY, OCTOBER 30, 1897.

THE DEADLINESS OF THE HARMLESS.

There is an ancient sentiment of the human mind which is continually receiving unexpected corroboration from modern sources. It has expressed itself in various ages in the paradoxes that the Gods are jealous of prosperity, "Woe unto you when all men speak well of you;" "It's dangerous to be safe," etc. Self-contradictory as it appears, it has a basis in fact and nowhere has this been more surprisingly demonstrated than of late years in the realm of dietetics. Wine, for instance, was to the patriarch a thing "which maketh glad the heart of man;" to the apostle the very life-juice of the universe, the best symbol of the blood of Christ; to Old Omar "the gift of God," "the Mighty Allah;" to the Greek, the crimson joy of the universe; but now, thanks to that distinguished band of scientists, FRANCIS MURPHY, T. DE WITT TALMAGE and FRANCES WILLARD, we know it in its true colors as a demon, an adder, a corroder of mucous membranes, the mother of murder and the grandfather of gout.

Again, what could have been more guileless in appearance, more blandly innocent in (and of) flavor, than the harmless, necessary potato, and yet after enjoying the confidence of the human species for centuries it has just recently been unmasked and denounced publicly, by no less an authority than the great Mrs. RORER, as a treacherous member of a murderous family, the Solanaceæ. Innocent as it appears, it is a first cousin of the deadly nightshade, the reformed member of a vegetable "tribe of Ishmael," and in the circus-poster language of the LOMBROSO mountebanks, "a criminal born." In spite of all the pains lavished upon its education it may "revert" at any moment and anyone who would avoid an attack of solanin poisoning is adjured by Mrs. R. to shun the treacherous tuber, and under no circumstances to imbibe more than one *per diem*. So that the real trouble with Paddy is not the potheen but the "praties." Like Mr. PICKWICK after the cricket-dinner, "It washn't the champagne, it wash the shalmon!"

Of course every person today who is half-educated knows that to indulge in the juicy grape or fragrant raspberry is simply equivalent to tempting "Providence" (the orthodox term for anything discomfortable), in the shape of an attack of appendicitis.

But worse is to come. When the denouncers of the drink demon had succeeded in dragooning us into shunning the flowing bowl and contenting ourselves with the lady-like lemon and the chastely cool soda-water, we were assured that the battle of Armagedlon was practically won and the race saved. Now, however, in the fullness of time arises another prophet from our own ranks to cry aloud and spare not, in the columns of one of our esteemed contemporaries, against the terrors that menace our national life in the increasing consumption of acid foods and drinks. According to him the situation is most serious. The depraved palate of New York City requires more than twenty-five carloads of lemons *per diem* to glut its cravings. Oranges and limes are poured in, in equally appalling quantities. "The grateful acid of the rhubarb in conjunction with binoxalate of potash, with the malic acid contained in gooseberries, currants, cherries, plums, apples and pears adds to the acidulous tide!" "Tide" is no word for it; "avalanche" is the only adequate term.

Tomatoes have "multiplied in production ten times since 1800 until, from comparative obscurity, they have reached the head of the list." And we wonder that heart disease and cancer are on the increase, both of which, as everyone knows, are due to the acid of the truculent vegetable. Sergeant BUZFUZ had indeed a gleam of deepest prophetic insight when he thundered "Chops! merciful heavens, gentlemen of the jury, and *tomato sauce!* Are the hearts of confiding females to be broken in this fiendish manner!" "Forty thousand tons of cucumbers and a million gallons of vinegar" are certainly enough to set the national teeth on edge. Even the preservatives which are added to the canned fruits are by a positive fatality "acids" too, salicylic and boracic, although no one would know it from their taste or effects, but "'tis down in the play" and adds to the general acidulous ruin. "Thirteen millions of pies per week," 80 per cent. of them acid, of course, while a fashionable dinner is "a feast of sours and a flow of acids from first to last."

And this is only the solid half of our sins of sourness, for "the realm of acid ingesta geometrically expands when we enter the domain of drinks." It is true that the floods of mineral waters give our scient-

ist pause for a moment, but only a moment, for do they not contain acid also? Certainly, carbonic acid, and behold another nail in our coffin! In his despair he cries aloud that "the acidulous habits of the body mark a stage in civilization," this golden Victorian era is an acid age, an age of puckerings, of wry faces, of sour stomachs.

So terrible is the prospect that his reason well-nigh totters on its throne, and he detects the deadly traces of sourness in the smell of things, nay even in the very sound of words. The innocent term "ascetic," for instance, which to uninitiated ears has almost a note of sanctity, becomes to him phonetically full of deadliest significance. "The modern fashionable women are rendered not only somatically but also psychologically *ascetic*," we are assured, and the prophecy closes with this awful threat of doom, that "the coexistence of somatic and psychologic *asceticism* can no longer be ignored!"

And to think that this fearful fate is hanging over all of our ignorant heads and we can not even grasp what it means when we are told in plain English.

Would we fain know just how are these tons and oceans of acid ingesta to produce their harmful effects? By "reducing the alkaline bases and salts in the fluids and tissues of the economy," and as "the alkalinity of the blood is the measure of its germicidal capacity," one can easily see what terrible things may happen. What makes the situation so serious is that with the obstinate short-sightedness characteristic of mere theorists, all our psychologists assure us that the vegetable acids, including acetic, are promptly converted into alkaline carbonates, that all fruits and vegetables contain large proportions of sodium, potassium, calcium and magnesium in combination and *increase the alkalinity* of the blood and lymph. Not only so, but our physicians are under the same grave delusion, and insist that in scurvy, for instance, which is caused by a deficiency of vegetables and fruit-acids in the diet, the blood becomes acid and can be restored to its normal alkalinity by those acids of acids, lemon-juice or pickled limes. And to such lengths is this blind perversity carried that citrates, acetates, tartrates and even lemonade and acid fruit-juices are freely given in rheumatism and gout, cystitis or any condition in which lessened alkalinity of the blood is suspected, thus really, according to Dr. ENGLISH, adding fuel to the flames. And, of course, having once committed themselves to this position they are going to brazen it out to the end, for they unblushingly declare that the appalling "sour habit of the American stomach," next on our author's list of horrors, is produced entirely by the acids of fermentation of starches, sugars or fats, lactic, phosphoric, butyric or by an excess of HCl, none of which are in any way related to the acids of foods and drinks, but are animal and mineral instead of vegetable. But all these are of course simply instances of the absurd positions into which the scientific mind permits itself to be drawn step by step by the fatal chains of logic and necessary causation. Turn the light of common sense upon them and they collapse at once. The thing tastes acid, it smells acid, it is called "acid," it *is* acid and must inevitably turn anything sour to which it is added, even the fluids of the human body. The damage which we have done and are doing in our ignorance is simply blood-curdling to think of. "Blood-curdling"—why, there is another acid at work, and what must be the coagulating effects of this "acid tide" upon the milk of human kindness. No wonder the race becomes more cruel and wicked every day. And think of the irrepressible conflict between this overwhelming sourness and the "sweetness and light," which we are so vainly striving toward. But there is a ray of personal comfort in this for our prohibition friends. Think of all the agonies and discomforts that they have endured both personally and by proxy in depriving themselves and others absolutely of the enjoyment of the "good creature" in every form, when it was only the acid ones which they need have shunned. For no one, we feel sure, can read Dr. ENGLISH'S eloquent denunciation without becoming convinced that at least two-thirds of the evil effects attributed by temperance reformers to alcohol are really due to the acids with which it is usually combined (or the human "chemicals," or the eye of the writer, or anything else *but* the alcohol).

This will at last explain why almost the only penalty to be paid by the (alkaline) beer-drinker is to become "fat and scant o' breath" after forty, while the (acid) wine-bibber lays up a future of gout, insanity and Bright's disease. Why the man who mixes soda with his brandy and Apollinaris with his whisky lives to a good old age, while the imbiber of "sour mash," champagne or gin-fizz, winds up with a private view of the pink alligator and a stomach-lining like that of a condemned boiler. The danger of the wine-cup is literally in its sparkle, for that is due to (carbonic) acid. Cassio's tragic apostrophe should read in the light of this revelation: "Oh thou invisible spirit of wine, if thou hast no name to be known by, let us call thee CO_2!" And as every free drinker will tell you the real "stingo" of the Manhattan cocktail lies in the (acid) cherry at the bottom of the glass. No wonder that alkalies relieve that familiar dark red taste in the mouth. To be alkaline is to be safe.

THE MORTALITY OF HEATSTROKE.

During the record-breaking weather of the month just ending there have been a number of prostrations from heat in some of our cities, and a consideration of sunstroke may therefore appear less unseasonable than might otherwise be the case. It is suggested at this time, however, by an article in the *Sanitarian* for

October, which originally appeared in the *Spectator*, a life insurance publication. The author, Mr. FREDERICK L. HOFFMAN, has analyzed the available statistics of mortality from heatstroke, and his conclusions and deductions are certainly deserving of notice and comment in a medical publication.

It is a curious fact that has not infrequently been remarked upon, that the death rate from this cause is extremely light in our more southern cities as compared with that of many of the northern ones. The statistics here given show this and something more; while the summer of 1896 had beaten the record in this respect up to that date in New York, Philadelphia and St. Louis, and in the two first named cities at least there had been up to 1896 an apparently progressive increase for a number of years back, in Cincinnati, on the other hand, there has seemingly been of late years a correspondingly steady decrease of deaths from this cause. It is evident from these facts that mere solar heat is not the only efficient factor, for, as Professor TROWBRIDGE remarks, in the *Monthly Review of the Weather Bureau* for 1896, the inhabitants of Boston suffer under a temperature which is readily endured by those of New Orleans, and a personal factor, the accommodation of the individual to physical environment, must be added to that of the actual climatic conditions. His "provisional index," however, "that sunstroke becomes imminent during the summer months when the mean temperature of any one day, or of several consecutive days, becomes equal or nearly equal to the normal maximum temperature for the same period," does not appear to practically cover all the facts, as such days must occur as frequently in Cincinnati or Chicago as in New York, where the death rate from heatstroke is highest. It would seem that we should also consider other factors as well as heat alone, and as New York is the great entry port for immigration, and statistics show that the mortality as compared with the number of cases amongst the foreign born is very much greater than amongst natives, though the number of cases may not be so disproportionate, we may, as has been generally done, count acclimatization as one important factor. The Italians alone, in Mr. HOFFMAN'S statistics, appear to enjoy a corresponding immunity, but the figures given are too small for generalizations.

Acclimatization alone is, however, not a sufficient reason for the difference between the eastern and western or southern cities, and the well known and often quoted fact, that is supported also by the insurance journals' statistics, of the evil influences of alcoholic indulgences will also afford no explanation of this regional difference. Why sunstroke should be so much more fatal in New York with a maximum temperature of 94 degrees, than in Chicago with one of 98, Cincinnati with one of 96, or St. Louis with one of 100, is not entirely clear; the conditions of living, etc., are not so obviously in favor of the last named cities as to afford any ready explanation. In New Orleans and other southern towns, and possibly to a certain extent in Cincinnati and St. Louis, it may be reasonable to assume that the habits and customs are more sanitary as regards exposure to heat; the residents do not expose themselves as a rule with the same recklessness as do the laboring classes of the north, who furnish the greatest part of the victims of heatstroke, and to this it is probable that they owe in great part their immunity. But even this may be insufficient to altogether account for the fact; there may be other elements, climatic or otherwise, of which we know little or nothing, that come into play to reduce the mortality. Consideration of the local conditions is certainly inadequate to satisfactorily explain all the phenomena that are sometimes observed.

If heatstroke is due to a toxin as some have suggested, whether of external or internal origin, there is need for its careful and thorough study to check the waste of human life from this cause. There are other affections, far less fatal in the aggregate, that have claimed and obtained more attention, and there are not so very many that when not fatal are yet so disastrous in their after-effects as is this. In view of this last fact which, considered in all its aspects, is even more serious than the actual immediate mortality (though this may, as in 1896, reach into the thousands in this country), we are not likely to over-estimate the importance of this accident.

THE BACTERIOLOGY OF WHOOPING COUGH.

While it is generally agreed that whooping cough is an infectious disease, there is as yet no agreement as to the specific micro-organism to which etiologic activity can be attributed. Such organisms have been described by BURGER (*Berliner Klin. Wochenschr.*, 1883, No. 1); by AFANASSIEW, who in 1887 isolated a bacillus; by RITTER (*Deutsche Med. Wochenschr.*, 1892, No. 45, p. 1020), who found in the bronchial secretion a diplococcus, and by KURLOFF (*Centralb. f. Bakteriologie*, Vol. xix, Nos. 14 and 15), who isolated a ciliated ameba. It is still a matter of doubt which, if any, of these is the actual cause of the disease.

To these contributions to the subject another has been recently added by CZAPLEWSKI and HENSEL (*Deutsche Medicinische Wochenschrift*, 1897, No. 37, p. 586), who describe the isolation of bacilli corresponding in some respects with those observed by BURGER. The observations were made with fresh sputum, obtained directly after a paroxysm of coughing. The more dense flocculi were selected and washed with agitation not less than thrice in tubes containing peptone-water to remove the more gross contaminations. Streak-preparations were then made and stained with diluted carbol-glycerin fuchsin or with diluted carbol-fuchsin. For cultivation, LOEFF-

LER'S serum in Petri dishes was employed. The micro-organisms isolated by these means proved to be small, slender bacilli with rounded extremities. They resembled in several respects influenza bacilli, from which they differed, however, in growing upon ordinary culture media. They varied considerably in size. The smallest bodies resembled cocci, and those in process of division diplococci. The developed bacilli are two or three times as long as thick. In cultures, less commonly in the sputum, the organisms were joined in more or less long filaments. In their morphologic variability they resembled plague bacilli, which, however, are much larger. They are immobile, and permanent forms could not be made out. The bacilli can be stained with ordinary aniline colors and by GRAM'S method. They are usually found in the sputum in large numbers in severe cases of whooping cough. They are principally free, but less commonly enclosed within cells. At the beginning of the disease bacteria are present in small numbers and are to be found only with great difficulty. When the sputum is not washed thoroughly other bacteria are found, the presence of which interferes with the development of the organisms in pure culture. Experiments upon animals have thus far proved unsuccessful. The organisms described are believed to be the cause of whooping cough, having been found in all of the thirty cases examined. This assumption was strengthened by the discovery of the bacilli in several cases at the time unrecognizable clinically as whooping cough, but which subsequently developed the disease. The organisms described were found in the nasal secretion. Further, one of the authors was seized during the progress of the investigation with severe coryza, accompanied by constitutional disturbance and slight cough, on one occasion paroxysmal. The whole attack lasted but one week, but the organisms in question were repeatedly found in the nasal secretion, apparently in pure culture.

ON RETROPERITONEAL AND PERIRENAL LIPOMA.

As is well known, the fat normally present around the kidneys is liable to overgrowth when these organs are diseased; especially when the kidney has undergone atrophic changes is an apparently compensatory hyperplasia of fat liable to occur—compensatory in the sense that it replaces the loss of volume due to the shrinking of the kidneys. But there is another form of overgrowth leading to the development of large neoplasms in which the kidneys primarily seem unaffected. Prof. J. GEORGE ADAMI, of Montreal, has recently subjected the instances of this form of tumor reported in the literature to a careful study and added two cases of his own.[1] This article must be considered as timely because there does not exist any general résumé, in our language, of this form of abdominal tumor.

[1] Montreal Medical Journal, January and February, 1897.

Prof. ADAMI'S first case occurred in a man 45 years old. It concerned a huge retroperitoneal lipoma which presented areas of mucoid degeneration and in other parts a structure resembling sarcoma. The tumor weighed no less than forty-one pounds; the left kidney was imbedded in the growth, the ureter passing down along the back of the tumor, the right kidney being unaffected. Death occurred, after symptoms referrable to the abdomen had existed for about eleven years; during the last weeks of life large quantities of pus were removed by repeated aspirations, in all about sixty pints. An exploratory laparotomy had been made, but the relations of the solid tumor, occupying practically the whole abdominal cavity, did not warrant any attempts at removal (Dr. SHEPHERD).

The second case occurred in Brooklyn under the care of W. W. BROWN, the specimens being deposited in the Army Medical Museum at Washington. A slowly growing abdominal tumor existed for two years before death, which resulted from acute pulmonary disease. At the autopsy an irregularly flattened tumor, weighing forty-one and a half pounds, was found adherent to posterior peritoneal wall and exerting marked pressure on the abdominal viscera and the diaphragm. The descending colon passed over the growth and the left kidney was imbedded in and firmly fixed by adhesions to the tumor. Microscopically the tumor consisted "largely of adipose tissue in a voluminous stroma of embryonic connective tissue with abundant nuclei between the fat cells."

ADAMI found forty similar cases recorded in the literature. The most important previous contributions are those of TERILLON[2] in France, who collected fifteen cases, and by JOSEPHSON and VESTBERG[3] in Sweden, who analyzed thirty cases.

As to the primary seat of origin of these huge lipomas exact statistics can not be given. ADAMI divides them into those of peritoneal origin, those whose origin was doubtful, and into those which appeared to have originated either in the mesentery or its root. About one-third of the cases may reasonably be described as having a perirenal origin; the largest collection of retroperitoneal fat occurs physiologically around the kidney and here is a most likely place for retroperitoneal lipoma to begin. The condition is more frequent in women than in man, in the proportion of 25 to 16. The tumor occurs almost exclusively in middle and late life, but in LAUWER'S[4] case the growth was recognized fourteen days after birth and "growing steadily, attained such a size and led to so much emaciation, that when removed at the age of seven, it weighed six pounds, or almost a third of the total weight of the child after its removal (twenty pounds).

The rate of growth of this form of tumor is slow.

[2] Arch. Génér. de Méd., 1886, p. 258.
[3] Hygeia (Stockholm), lvii, 1895, p. 369.
[4] Josephson and Vestberg, l.c.

On an average between two and three years elapsed between the first recognition of the tumor and removal, or death of the patient. In some cases the growth was observed for five, seven, eight and even twelve years. The size attained in the majority of the cases exceeded twenty English pounds, in weight; many were above forty and fifty pounds and one weighed sixty-three pounds.

The general disturbance is slight. Case after case is recorded without pain or disorder of the intestinal or urinary functions. As the end approaches pain may shoot down the extremities and edema of the legs may develop. Extreme emaciation and dyspnea are common features.

The definite presence of fluctuation has frequently led to diagnostic errors. Ascites, multilocular ovarian cysts and echinococcus cysts are examples of false diagnosis. A fluctuating abdominal tumor of the abdomen from which repeated puncture fails to draw fluid should lead one to think of lipoma.

The divergent descriptions of the histology of these growths are easily reconciled by the fact that every member of the group of connective tissue tumors may pass into or show areas of metaplasia into other members of the group. Hence all forms of mixed mesoblastic tumor tissue may be met with in varying proportions. True fibro-chondro-osteo-lipoma may occur.

In the forty-two cases, twenty-six extirpations, complete or almost so, were made with success in twelve cases or 46.1 per cent. In general the huge mass peels out with fair ease, though accessory lobules often have to be removed after the main mass has been shelled out. Recurrence is rare. In most of the fatal operations death may be attributed to the cutting off of the blood supply of the overlying intestine, followed by gangrene. When possible the tumor should be removed by lateral or lumbar incision. If this is impossible without gross injury to the peritoneum then free excision of the overlying intestine must be made as has been done in several cases.

In recapitulation: A retroperitoneal lipoma may be suspected when there is a very slowly growing tumor oftener situated more toward one side, accompanied by no special symptoms except progressive emaciation and eventual dyspnea, crossed by a length of intestine, and giving a sense of fluctuation, from which, further, repeated puncture fails to draw fluid. Successful operation presupposes the preservation of the blood supply of the intestine crossing the tumor; if the supply of blood is endangered resection of the intestine becomes necessary.

THE REFORMATION IN ENGLISH SPELLING.

A valued correspondent invites our attention to a letter by Mr. ROBERT BARNES, and another by Dr. JOHN WM. MOORE, both on the subject of "Reform in the spelling of the medical vocabulary," in the venerable London *Lancet* of October 2. Both these writers deprecate any change in the sacred diphthongs, and inasmuch as these were used in the original Greek, according to Dr. MOORE, we must continue to use them. This would all be very proper if we were speaking Greek, but as we are speaking English, we do not see why it is any more difficult to trace the etymology of a word in the one case than in the other. Even in Dr. MOORE'S letter it is shown that "empyema" was the spelling of the word, and therefore instead of deviating from archaic models, we are simply returning to them. What about the Greek words that are from the Sanscrit? The same argument logically applies, and at the last we must, if etymologic exactness be required, go back to the Egyptian and Assyrian hieroglyph.

Moreover, it is of no use for the brethren to waste their time in fighting for the reinsertion of letters which time has shown to be obsolete and which simply add to the difficulties of English and accomplish nothing; we might as well return to the spelling of CHAUCER and SPENSER for ordinary English words. The English language has grown by evolution, one might say by excision. As we have before pointed out, nobody now spells thigh "thighe" or leg "legge," and yet this was the mode of spelling during the first half of the 16th century. We suppose that many learned heads were shocked at the dropping of the letters, and Dr. MOORE himself admits that "changes are constantly taking place and will in the future take place." Some of our transatlantic brethren still retain the u in "labour," "ardour" and "colour," and the k at the end of the word "musick," but we doubt if the Americans have time, much less inclination, to reinsert these superfluities, and if the Americans are a little faster than the English and have adopted these reforms more quickly, it is not from any disrespect to the language, nor the source from which it is derived, but from a desire to economize time, labor, material and money. Then, if the Americans can improve the language by pruning its excesses and eccentricities, the Englishman should at least rejoice with us in the establishment of a more modern language in which he need have no part.

THE NEW YORK STATE MEDICAL ASSOCIATION.

The annual meeting of this society was held in New York October 12, 13 and 14. The most interesting part of the meeting was the discussion of the abuses of medical charities. Dr. WIGGINS opened the subject with a startling array of figures from Dr. STEPHEN SMITH'S report. Among them was noted the startling fact that at least 49 per cent. of the entire population of New York city was receiving free medical care and medicines. A number of physicians followed adding equally strong testimony, and show-

ing that most of the great charity clinics and hospitals were literally pauperizing and creating more abuses and distress than they relieved. While this is an old story in New York, and an outrage on progress and rational science, which the profession submit to with stolid indifference, it is strangely spreading to other cities and even small towns of the country. Within a few months over a dozen hospitals and free dispensaries have been established in small suburban cities and villages, with a flourish of names and donors as if they were really charities. The profession have themselves to blame for this sad state of miscalled charities. This discussion only brought out in clearer light an evil, which it is hoped the leaders of the New York medical profession will cure with skill and success. It is a curious commentary on the fads of the profession, that twenty-six of the forty-five papers read were on surgical subjects. Two on alcohol and tobacco, one on expert testimony, one on materia medica, and twelve on abuses of medical charities and allied subjects. This meeting always brings together a large number of country and village practitioners of the better class, and the papers and discussions are always of a high order, and very practical. While the New York medical teachers contribute their full share of papers, the men from outside are equally clear and practically scientific, their contributions are as eagerly followed, and many of them are better contributions to medicine. It is interesting to note that this Association is the only State society with a permanent home in America. The Mott Memorial Hall was a gift of that distinguished surgeon, and includes a fine building, library and museum, with a fund to perpetuate it.

By an arrangement with the trustees the New York State Medical Association came in possession of this property, and through its trustees continue the care and management of the building, and hold its annual meetings and committee meetings in its halls. The building and site are valued at $80,000, and the museum and library are equally valuable. The New York State Medical Association is the permanent trustee and manager of this property, using it for their purposes, and it is open to members as a place to resort while in the city. The library is open to the public, and contains a rare collection of books on medicine, and a very extensive pamphlet and journal literature. This Society has always been in close affiliation with the AMERICAN ASSOCIATION and has done much to redeem the mistakes of some other medical men in this State. The president elect was DOUGLAS AYERS, M.D., of Fort Plain, N. Y., and the secretary, the well-known E. D. FERGUSON, M.D., of Troy, N. Y. This Association is divided up into five district societies which hold quarterly meetings in different parts of the State. These meetings are very popular and largely attended, and are noted both for their social and scientific attractions. The interest which they create extends to the State Association, and is in many respects a model for other State societies.

CORRESPONDENCE.

Ballston Springs, N. Y. as a Resort for Invalids.

HARTFORD, CONN., Oct. 23, 1897.

To the Editor:—In answer to some inquiries, I would say that the famous old watering place of Ballston Springs, New York, is practically an ideal place for nervous and dyspeptic persons who need a change of surroundings, with quiet, and nature's great remedies, mineral waters. Half a century ago this was the most prominent mineral springs resort in America. Saratoga, four miles north, was a mere hamlet. Now Saratoga has become a great center of hotels, sanitariums and springs, and Ballston is a quiet, dreamy suburban village. Down in a valley protected from the high winds, in the dry bracing air of the Adirondack snow belt, free from fogs and sleet storms, it has many attractions as a residence for invalids. To many persons the invalid atmosphere of sanitariums and the unrest and excitement of hotels are depressing and injurious. Whereas the geniality and quietness of a private family is a strong tonic of great value. The springs of Ballston are the same as at Saratoga, being on the same mineral belt, and are mostly soda, magnesia, potassa, iron and lithia waters. Some of them are strong carbonated waters and very agreeable to the taste. I should urge invalids from deranged digestion and nervous debility, to go to Ballston, select some private house as a home, near some of the many springs, and drink freely of the waters. This, with the rest and change, will bring a recovery and full and final restoration in many cases. This advice followed by an invalid physician, resulted in his return home restored after a two months residence. Personally I have seen most excellent results from the use of these waters drunk at the springs regularly every day, and I am convinced many persons supposed to be chronic cases would be restored by such treatment. Beyond this a number of persons who are semi-invalids, would find this an excellent place for the change of scenery and surroundings. The town is a very old one and rich in historic interest, and contains many quiet old homesteads where visitors can find most agreeable places of residence. I believe the waters and the quiet restful atmosphere of Ballston, make it far superior to many foreign springs that are famous resorts, and it will be a pleasure to be of any assistance to any one who would like to spend a short time at this place. T. D. CROTHERS, M.D.

Lepers of New York Turned Loose by the Board of Health.

NEW YORK, Oct. 20, 1897.

To the Editor:—The public be d——! Whether leprosy is contagious or not does not seem to be the question with our New York Board of Health. The point is to escape responsibility, care and trouble. Let the leper go; we are glad to get rid of him on any terms!

It is a lamentable circumstance that such devil-may-carelessness should exist just on the point where it can do the most evil. New York is the most important port of our country. The lepers are foreigners; most of them come from Norway, Sweden, Iceland, South America and the West Indies to New York. Most of the lepers who live in Minnesota and Wisconsin came through New York. Had they remained here instead of going to those far-off States, would the New York Board of Health dare to have let them run loose? Horrified public opinion would have compelled their isolation.